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Automated Intelligent Training with a Tactical Decision Making Serious Game

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14. ABSTRACT *(Maximum 200 words)*:
The Intelligent Game-Based Evaluation And Review (InGEAR) capability is a game-based training system that affords junior officers the opportunity for self-training in tactical command skills. This leverages two existing technologies: (i) "Follow Me," a small unit leader tactical training game used by instructors and cadets at the United States Military Academy at West Point, and (ii) an intelligent tutoring system (ITS) for automated delivery of tailored evaluation and feedback in scenario-based exercises. InGEAR's objective is to combine game-based training capabilities with learner-centric scenario editing, performance assessment, and feedback to enhance learning and simplify instructors' taskload. These capabilities provide instructors with viable options for dealing with time constraints that limit the opportunities most cadets have for direct feedback on their own decisions and performance.

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AUTOMATED INTELLIGENT TRAINING WITH A TACTICAL DECISION MAKING
SERIOUS GAME

EXECUTIVE SUMMARY

Research Requirement:

This report describes a game-based training capability developed to support self-directed
training in small unit leader tactics. The Intelligent Game-Based Evaluation and Review
(InGEAR) capability combines two technologies: (i) "Follow Me," a small unit leader tactical
training game used by instructors and cadets at the United States Military Academy at West
Point, and (ii) an intelligent tutoring system (ITS) for automated delivery of tailored evaluation
and feedback in scenario-based exercises. InGEAR's objective is to combine game-based
training capabilities with learner-centric scenario editing, performance assessment, and feedback
to enhance learning and simplify instructors' taskload. These capabilities provide instructors
with viable options for dealing with time constraints that limit the opportunities most cadets have
for direct feedback on their own decisions and performance.

Procedure:

InGEAR was developed in several iterations over the course of a year, starting with
collaboration with end users to define requirements, and then moving through three software
development spirals with intermediate demonstrations and opportunities for feedback. The
primary result of the requirements process was to define a target set of evaluation measures used
as a catalog for the remainder of development. The three development spirals focused on
asynchronous assessment and feedback, followed by real-time assessment, and finally scenario
authoring tools. The fully operational capability was transitioned, with appropriate support
materials, after the third spiral review with end users.

Findings:

According to U.S. Military Academy (USMA) instructor and simulation center feedback
during the software spiral demonstrations, InGEAR supports a student-centered learning
experience within tactical leadership classes and increases an instructor's ability to tailor tactical
scenarios and performance measures to specific training needs. Additionally, by providing a
capability to automate tailored assessments and guidance as students work through various
scenarios, InGEAR also expands the ability of instructors to identify learning trends and assess
individual and class progress. In summary, InGEAR represents a practical application of game
technology for a real-world training use.

Utilization and Dissemination of Findings:

The *Follow Me InGEAR* capability has been delivered to end users at the West Point
Simulation Center, USMA, where instructional staff has expressed their intention to immediately
begin employing it to support tactical leadership training. In addition to the software

deliverables, the authors of this report also published a conference paper discussing approaches for generalization and reuse, in terms of specific observations derived from InGEAR development. Many of the tactical principles assessed in InGEAR are common to other domains and training environments. Because InGEAR is designed to support scenario authorability, it represents an initial step toward an abstracted assessment model for measures that can be easily applied in different scenarios. The benefit of such an abstracted assessment model is its potential to reduce development time and cost for situated tutors with a variety of virtual environments. Additionally, because *Follow Me* shares a common engine with Decisive-Point's *Crucible of Command*, which is currently in use in other training settings, there are opportunities to port InGEAR's assessment capabilities to other platforms.

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Introduction

This report describes a game-based training capability developed to support self-directed training in small unit leader tactics. The Intelligent Game-Based Evaluation And Review (InGEAR) capability combines two technologies: (i) "Follow Me," a small unit leader tactical training game used by instructors and cadets at the United States Military Academy at West Point (USMA), and (ii) an intelligent tutoring system (ITS) for automated delivery of tailored evaluation and feedback in scenario-based exercises. InGEAR's objective is to combine game-based training capabilities with learner-centric scenario editing, performance assessment, and feedback to enhance learning and simplify instructors' taskload. Additionally, by providing the capability to automate tailored assessments and guidance as students work through various scenarios, InGEAR supports a student-centered learning experience and expands the data available to instructors to identify learning trends and assess individual and class progress.

The InGEAR capability was developed in a collaboration between Stottler Henke Associates, Inc. and Decisive-Point, LLC, the developer of the *Follow Me* game in its original form that was previously in use at the USMA. The integrated "Follow Me InGEAR" application is considered a branch of *Follow Me* with ITS capabilities. Whereas the standalone *Follow Me* game is primarily intended for training settings where human instructors guide the training process, *Follow Me InGEAR* is intended for either instructor-led or self-directed use cases.

InGEAR was developed in several iterations over the course of a year, starting with a collaboration with end users to define software requirements, then moving into three development spirals for intermediate demonstrations and opportunities for feedback. The primary result of the requirements process was to define a target set of evaluation measures used as a catalog for the remainder of development. The three development spirals focused on asynchronous assessment and feedback, followed by real-time assessment, and finally scenario authoring tools. The fully operational capability was transitioned, with appropriate support materials, after the third spiral review with end users.

The following sections provide additional background for the use case at the USMA, discussion of more general game-based training methods, and more details of InGEAR's implementation. Appendices to this report include artifacts of the development process and deliverables, including an enumeration of assessment measures developed for InGEAR, and excerpted sections of the user manuals for the system.

Background

The goals for training tactical decision-making often focus on giving experiential practice under dynamic conditions where there is no singular best answer. While there may be best practices and even doctrinal guidance for elements of how a tactical plan should be conducted, there also can be many viable courses of action with different tradeoffs in speed, risk, and achieving mission objectives. Thus, training aims to combine the instruction of basic principles with the art of understanding the tactical situation, weighing alternatives, acting decisively, and

remaining flexible. In broad terms, this holds true for tactical decision-making at different echelons and in different operational settings. This makes scenario-based training highly effective for honing tactical skills, but only if experiential events are accompanied with guided feedback. Practice alone is not sufficient for learning; it must be tied to feedback which is closely linked to performance assessment (Salas, Rosen, Burke, Nicholson, & Howse, 2007; Ericsson & Ward, 2007). In complex decision-making domains, experienced human instructors are naturally expert at seeing performance patterns that call for feedback, either positive or negative. Therefore, the objective of an automated intelligent tutor is to replicate this kind of assessment and feedback in the unstructured interactive setting of a virtual environment, such as the small unit leader tactical training game, *Follow Me*.

The USMA currently uses *Follow Me* to facilitate the instruction of small unit leader tactical skills in the classroom. The traditional method for teaching these concepts to students includes lecture, written problems, the use of terrain boards or sand tables (see Figure 1), tactical exercises without troops, and finally tactical exercises in a field environment.

Figure 1. Sand table exercise at the USMA.[1]

Small unit training exercises performed in the classroom are relatively simple to conduct, but provide only an elementary understanding of basic concepts. In this setting, it is challenging for the cadets to accurately conceptualize the dynamic effects of time, space, distance, terrain, and capabilities in the execution of a tactical plan. At the other end of the spectrum, field exercises provide a greater understanding of dynamic tactical concepts and how they are applied, but are resource intensive and limited to the available types of terrain where training is conducted. The benefit of a game-based trainer is that it provides quick, fast paced, recorded exercises within a myriad of battle environments and against a wide variety of threats. By using these types of trainers, exercises can be completed by individuals or teams based on the complexity of the problem and the nature of the learning objectives.

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[1] Image used with permission of West Point Simulation Center, US Military Academy at West Point, NY.

According to USMA instructors using *Follow Me* in typical classroom settings, cadets normally review the identified tactical concepts for homework, discuss the principles in class, then conduct individual, single-player exercises within *Follow Me* that last about 15 to 20 minutes. Although some implicit learning occurs during scenario execution, most of the actual learning occurs afterwards with the instructor-led guidance provided in an after action review (AAR). Following the completion of an exercise, the instructor selects several cadets to brief the class on their decisions and thought processes while their exercises are replayed using the captured after action review log files on a large display (Figure 2).

Figure 2. USMA cadets conducting an AAR after a *Follow Me* exercise.[2]

As a student briefs his/her solution, the instructor facilitates discussion while the remaining cadets ask questions or share their opinions and insights. The instructor shapes learning by pausing the exercise playback at specific points where, in his/her judgment, the most significant teaching points occurred within the exercise. The instructor then asks questions or provides carefully worded comments to facilitate further discussion and enhance the students' understanding of what happened, why it happened, whether it was doctrinally correct or not, and how it affected the outcome of the mission. According to the feedback we received from instructors, this is an extremely valuable learning experience because of the individualized assessment and feedback. However, because of time constraints, most cadets have limited opportunities for direct feedback on their own decisions and performance.

An example skill often practiced within *Follow Me* involves the proper employment of weapons systems during a tactical operation. Figure 3 is a screenshot from the AAR for an exercise conducted by a USMA cadet. During the AAR playback of the exercise, the instructor pauses the playback in order to highlight critical shortcomings in the student's choice of

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[2] Image used with permission of West Point Simulation Center, US Military Academy at West Point, NY.

positions for the machine gun sections. In Figure 3 below, one of the machine gun sections is selected, with its sector of fire shown as a cone.

Figure 3. Machine gun section visibilities and sector of fire shown in *Follow Me* AAR.

Each machine gun section within an Army light infantry platoon constitutes 20% of that platoon's combat power and should be employed in areas where they can be properly controlled by the platoon leader. In this particular case, the selected machine gun section should have been located with the main body of the platoon for more effective command and control (C2). From the existing position it has poor visibility on areas of likely contact, which also means a lack of mutual support with the other machine gun section because of minimally overlapping sectors of fire. In Figure 3, a significant portion of the village area to the north is obscured from the viewpoint of the selected machine gun section, while the second machine gun section has a direct view of the buildings.

While the instructor knows the terrain and distances in the scenario, cadets often misjudge these factors during the game. Thus, the instructor must provide feedback to the cadet that effectively illustrates the concepts of positioning and mutual support. In a typical AAR for this exercise, instructors use the *Follow Me* distance tool to show spacing between units and the line of sight (LOS) function to graphically portray battlefield visibilities. The LOS tool produces an overlay that grays out areas that cannot be seen from a selected point on the battlefield because of elevation, terrain type, or objects.

The instructor-led AAR process involves execution playback, paused at key moments such as this one, with interactive discussion to review basic principles (such as spacing from C2

and mutual support) using visual cues provided by the game environment. It's also up to each instructor to elaborate on how these principles should apply in the presented scenario and identify the consequences of the student's decisions. While it is true that there will always be nuanced observations by human instructors that go beyond the capabilities of automated training methods, there are many instances where these primary functions can be effectively performed by intelligent software.

Automated Assessment and Feedback Implementation

Paired with the *Follow Me* game, InGEAR is an example of a "situated tutor" (see Schatz, Oakes, Folsom-Kovarik, & Dolletski-Lazar, 2011), as the game offers a scenario-playing experiential environment with a wide range of decision points and free play, directly integrated with adaptive instruction. Forms of instructional adaptation are often described in terms of when instructional decisions are tailored to the learner, i.e. where macro-adaptation occurs between exercise events and micro-adaptation occurs within events (Shute, 1993). Micro-adaptation is a major component of InGEAR's pedagogical strategy, with feedback tailored to the individual's performance in a scenario through a combination of measures.

InGEAR uses a constraint based approach to implement automated assessment and feedback for tactical decision-making principles exercised by *Follow Me*. While different student modeling strategies are suited for different forms of training, tactical decision-making concepts in a game-based setting present a unique challenge because branching is virtually unlimited. As Sottilare and Gilbert (2011) observed, the modeling task becomes complex with game environments because of the "…broader range of granularity of events and stimuli…" (p. 5), and the sheer quantity of additional variables involved. This is the practical motivation for using a constraint based approach which essentially looks for noteworthy conditions that reflect significant negative or positive states directly relating to training objectives without trying to match every action against a certain model (Ohlsson, 1994). Although a constraint-based approach lacks traceability to cognitive states, it has cost benefits because simpler student models do not need to represent all possible solutions and the sequences of cognitive states that produce them. Along these lines, Bratt (2007) noted, "Making sure the student is aware of constraints on actions, and possible positive and negative effects, can be very useful, even if these constraints and causal links do not provide a ranking of optimal actions." (p. 349)

Feedback Mechanisms

In practice, InGEAR's constraint based implementation organizes automated assessment and feedback mechanisms in a hierarchy of individual measures including both basic tactical principles (such as spacing from C2 and mutual support) and higher level concepts associated with the overall tactical tasks integrated within a scenario (such as destroy the enemy, or secure an area). The objective of this combination of measures is to approximate the content of instructor-led AAR discussions with cadets. Within InGEAR, each measure is based on input from subject matter experts and the USMA instructional staff to establish methods for assessing performance for different tactical principles without relying specifically on specific game attributes or scenario assumptions.

In cases where performance assessment involves specific thresholds (e.g., separation by a certain distance in meters, proportion of units with poor cover or concealment, times to accomplish higher level tactical tasks), the assessment mechanisms are designed for parameterized implementation without hard-coding the thresholds that define good or bad. Within InGEAR, each measure is specified with a unique set of instructions for the computational logic to interpret scenario execution for conditions reflecting either positive or negative performance, as well as a set of rules for determining the nature of training feedback. The implemented instructions amount to a template, which can be easily adapted to different scenarios by configuring a small set of parameters. InGEAR structures assessment measures with three forms of feedback: real-time feedback, AAR playback, and AAR summary and analysis.

Real-time feedback. Also known as immediate directive feedback, this involves prompts or cues delivered in the game environment during the execution of an exercise scenario. Several studies have demonstrated the benefits of immediate and directive feedback (see Anderson, Corbett, Koedinger, & Pelletier, 1995; Dihoff, Brosvic, Epstein, & Cook, 2004; Jensen, Sanders, Marshall, & Tasoluk, 2005; Kulik & Kulik, 1988), although each application faces the challenge of finding the balance between the feedback's instructional value and its potential for interrupting exercise flow. A real-time feedback mechanism functions just like an instructor overseeing a classroom exercise, who withholds critical feedback until the AAR, but still gives comments or tips during the exercise when needed.

In order to support a range of use cases, InGEAR divides real-time feedback into two categories for different modes of training or practice: coaching and exercising. In concept, the coaching mode is designed for early practice of tactical skills and typically without results being used for performance grading or assessment. The exercising mode is designed for assessments of the student's knowledge and performance during an exercise when results may be used for grading. In the coaching mode, real-time cues and feedback are more frequent and explicit, with less concern for interrupting game flow or influencing player outcomes. In exercising mode, real-time feedback is scaled back for minimal intrusion, without impacting player actions still to come. However, these modes can be used in different ways by changing the parameters used for the timing or content of feedback as instructors or scenario authors see fit.

AAR Playback. The system-guided AAR playback is directly analogous to how instructors currently use game playback for feedback. In order to enhance the playback, bookmarks are automatically created as a result of real-time assessment results during an exercise. In some cases, post-facto reflective analysis considers the scope of the entire exercise to draw conclusions about specific times to highlight, which are included as bookmarks. Each bookmark is associated with one or more assessment measures, which are defined with templates for how the corresponding tactical principles can be illustrated. A learner engaged in self-directed training can either let the entire playback run with pauses at each bookmark, step through the bookmarks by iterating through the list, or go directly to the bookmarks that are of the most interest. Figure 4 shows the playback controls and list of named bookmarks generated from a typical exercise. In AAR playback, events are paused at each bookmark, as an opportunity to give feedback that illustrates the tactical concept and how it applies in the current situation.
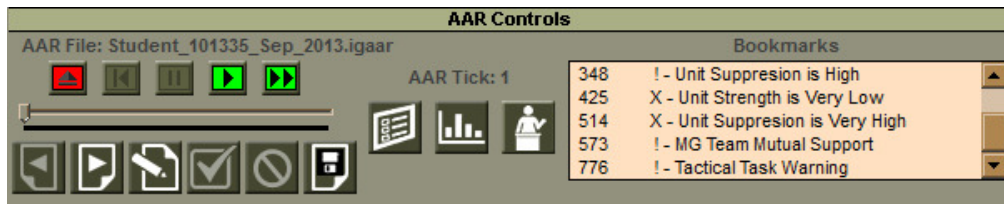
Figure 4. Playback controls and bookmarks.

Based on the template used for the associated assessment measure, feedback may include text, highlighting of one or more units, visual effects presented as overlays on the tactical view (such as the visibilities and sectors of fire shown in Figure 3), and even multimedia. Also the text may be declarative or interrogatory, where in the latter case the student may answer a multiple choice question or provide a free-text answer that would be saved into the AAR log. The explanatory information for a playback bookmark is only shown while initially paused, and then disappears when resuming playback or skipping to another bookmark.

AAR Summary and Analysis. In addition to the AAR feedback provided directly via playback, additional feedback is available that provides an overall summary and analysis of exercise performance and various statistics (Figures 5 and 6). The unit status graph in Figure 5 is a feedback mechanism presenting information about unit status over time in graph form to convey higher level observations about key points in the exercise that may not necessarily be tied to individual performance measures. For example, a graph of massed effects and lethality on the same timeline with unit status, ammunition levels, fatigue, and other related measures helps provide insight on the tactical situation in a way that was not previously available to instructors and cadets.
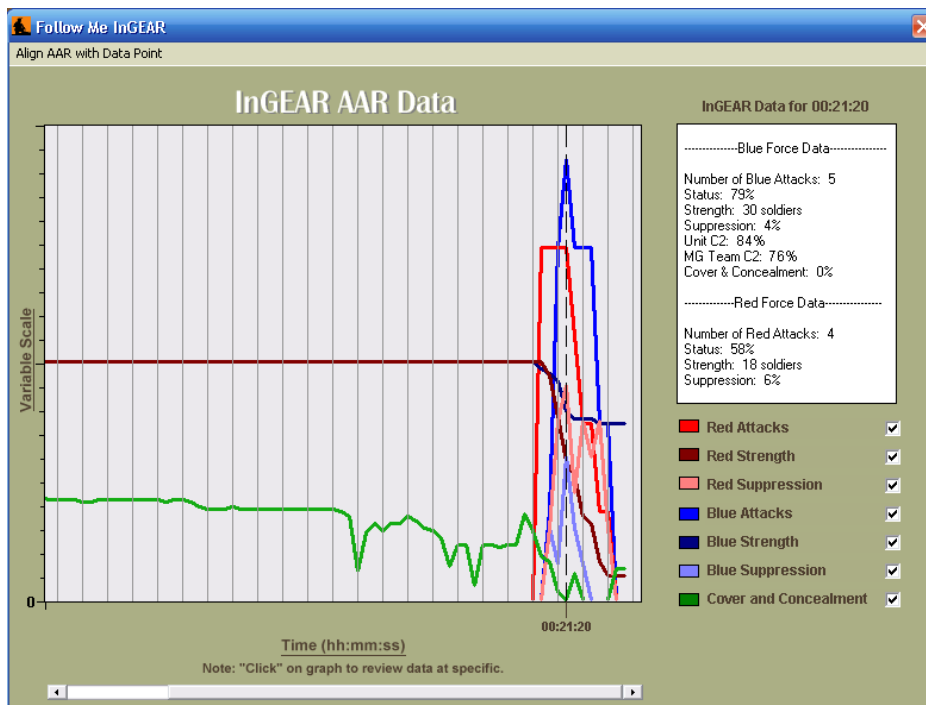

Figure 5. Unit status graph in AAR summary.

Figure 6. AAR summary report.

The design of the assessment measures resulted in a specification that defines the nature of the feedback to be delivered for each of the categories above. Referring back to the earlier tactical examples of C2 spacing and mutual support described in the context of instructor-led training, each appear in the InGEAR implementation as unique assessment measures. Real-time feedback for each of these measures is only provided in coaching mode, where it is useful to give immediate feedback about what is wrong with the relative positions of units. Feedback for these measures is not available in exercising mode, because presenting this feedback during an exercise would have the potential to significantly impact overall outcomes critical to performance assessment and experiential learning. The automated assessments for both of these measures generate corresponding playback bookmarks for AAR that illustrate concepts in context with the same in-game visual effects typically used by instructors (e.g., Figure 3). An overall performance assessment is given for each of the measures in the AAR summary report (Figure 6) based on how often the relevant problem conditions occurred in the exercise.

Example Assessment Measure

A more complex training example involves friendly fire incidents and fratricide. Avoiding fratricide is one of the foremost tactical principles not only for platoon level operations, but also for nearly every echelon and operational setting of kinetic live-fire warfare. While outcomes of concern may range from firing in the area of friendlies, to firing on friendlies, to causing casualties or actual fratricide, the underlying concepts in any of these conditions involve situational awareness, understanding weapon effects, and coordination of maneuver and fires. Thus, from a diagnostic perspective, there are several different conditions for fratricide related assessments to detect, potentially with more than one occurring in the same engagement event. For example in the simplest case, a fratricide incident occurring in the game environment

will typically include separate discrete events, where fire on friendlies precedes the actual fratricide event. However, the converse is not true; fire on friendlies may sometimes occur without leading to fratricide. Similarly, the order of events can provide important information about the underlying decision-making failures that led to a fratricide.

Figures 7 and 8 show a simplified set of scenario conditions where two different sequences of events end with the same fratricide event outcome, but with different preconditions that are important to capture and reflect in training feedback. The convention is that Blue (friendly) units are shown at the bottom, and a Red (enemy) target unit is shown at the top.
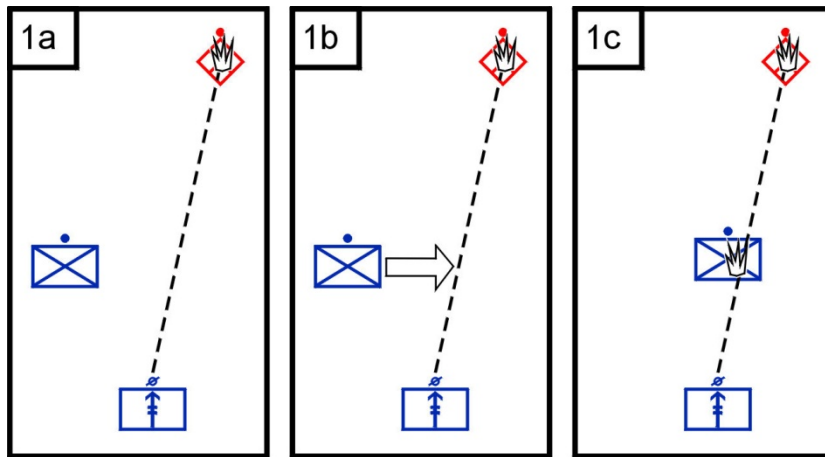
Figure 7. Fratricide event resulting from friendly unit movement into line of fire.

In the above sequence of events, the Blue machine gun team is actively engaged on an enemy target (time 1a), when another Blue unit moves into the active line of fire (1b), leading to a fratricide event (1c). In the game environment, there are two relevant operator commands: the engagement command on the machine gun team with the specified target, and the movement command on the second Blue unit. Also, implicitly, if the operator had an intentional tactical reason to move the second Blue unit, then the failure to stop the machine gun engagement is also significant.
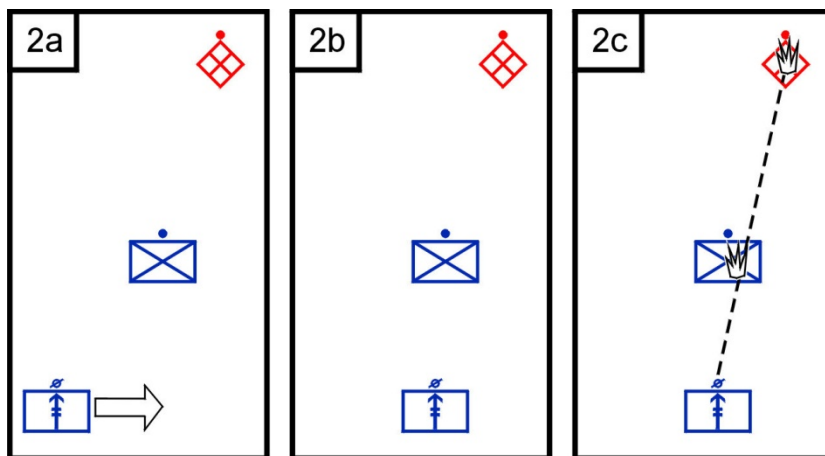

Figure 8. Fratricide event resulting from line of fire across friendlies.

In the second sequence of events shown in Figure 8, the main factor in the fratricide is the control of the machine gun team. Initially there are no fire events as the machine guns move (2a) and take a position (2b). Then the machine guns engage an enemy target despite the fact that the line of fire crosses another Blue unit, leading to the identical fratricide event outcome (2c) as in the previous example (1c). In this case, the significant commands are the movement of the machine guns and, more importantly, the engagement command issued to the machine guns with a line of fire passing over friendlies to the target. Implicitly, the failure to reposition either the machine guns or the other Blue unit before engagement may also be a factor.

Although the depictions above are intentionally simplified, these kinds of conditions do occur, especially in the more complex scenario environment where terrain features, buildings, and the nearly endless variety of relative unit positions come into play. In both cases above, all of the significant commands are reflective of decisions that should be factored into the feedback. Even in a constraint based approach where nominally the function of automated assessment is to detect states, it's important in a tactical decision-making domain to make sure that the notion of significant states is not limited entirely to outcome conditions like (1c) and (2c) above. By including prior actions and states in the assessment logic, the resulting feedback can effectively provide insights into the student's decision-making.

In the InGEAR implementation, there is also some processing in both real-time and the preparation of AAR to consolidate feedback for related or repeated conditions. For example, the engagement in which a fratricide occurs may involve many successive discrete fire events, but the objective for real-time feedback is to provide input exactly one time per incident, where an incident is defined by the fire command (using Engage or Assault in the game) and the unit receiving friendly fire. Likewise for AAR playback, the choice of the appropriate time for a bookmark is based on the nature of the incident. For example, in the events leading to fratricide in the first example above (Figure 7), it is ideal to create a playback bookmark at time (1a) or (1b), so the viewer can see the situation and how the fratricide occurred. Some of this information would be lost, or at least require additional rewinding steps to see, if the bookmark were simply placed at time (1c) when the actual fratricide occurs. This also helps to make the causes more apparent and reduce dependence on textual feedback explaining what's happening. The visual cues automatically generated for a playback bookmark also help to supplement the textual prompt. For example, Figure 9 below shows a close-up view from an AAR playback, where the friendly unit receiving fire is highlighted with impact graphics and a solid bounding square, with the active lines of fire being shown as well.
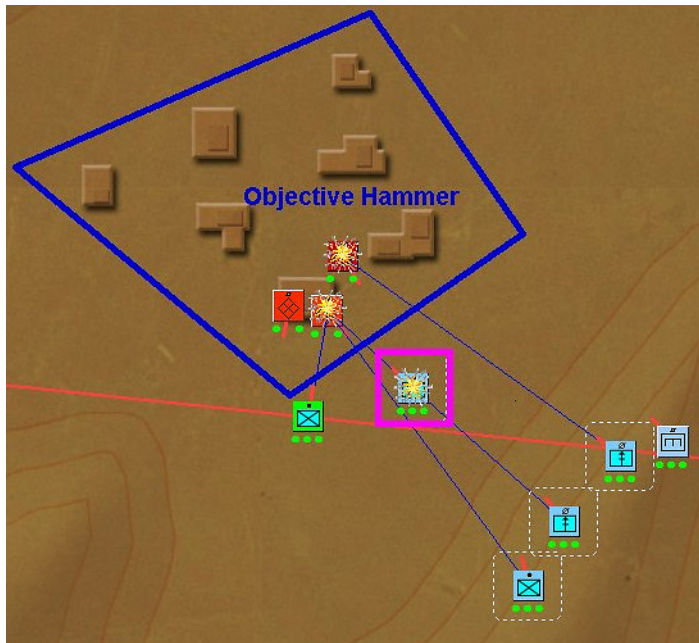
Figure 9. AAR playback bookmark for fratricide event illustrated with visual effects.

Authoring Tools

In addition to the core capabilities of automated assessment and feedback, a major InGEAR objective was to support scenario authorability by instructors, to enhance the system's utility for real world training. Using the previously existing authoring tools provided with *Follow Me* as a model, a templated structure was designed to facilitate the process of designating and instantiating automated evaluations with a scenario. By conforming to methods already in use for scenario authoring, instructors will be able to mark-up scenarios for automated intelligent training with minimal spin-up.

In order to support authorability, the evaluation measures were designed to generalize for application across a variety of scenarios. This required examining each assessment metric to identify parameters that could be abstracted as variables to simplify the process of instantiating assessment mechanisms with different future scenarios. This allows authors to use a set of templates for specifying assessments within a scenario by essentially establishing the parameters unique to the scenario without reconstructing the full assessment logic.

Interfaces and Utilities for Authoring

Several utilities were created to support the scenario authoring process and are described in the following sections.

InGEAR Editor. The InGEAR evaluation editor provides the main interface for controlling the instructional elements that will be activated in a scenario, and their parameters used in execution (Figure 10). This interface allows the author to specify the tactical task for a scenario, targeted units, protected units, and attached instructional handout. It also provides a list of all applicable evaluation measures, with the capability to control whether they will be actively

evaluated in the scenario and, if so, with what thresholds or parameters. The evaluation measures referenced in the InGEAR Editor are described in more detail in Appendix A.

Figure 10. InGEAR Editor tool for scenario authoring.

Unit Editor. The unit editor is mostly part of the existing *Follow Me* scenario authoring process, but it supports InGEAR evaluations in how units are designated. The capabilities assigned to units affect how they will behave in a scenario in accord with the instructional goals of the scenario. Also, in some cases, InGEAR evaluation measures are defined to consider special kinds of entities uniquely, such as an "unfriendly civilian," as a feature assigned to a unit in the unit editor.

Automated terrain analysis process. The InGEAR evaluation measure for Cover and Concealment requires a terrain analysis capability. The optimal approach is to preprocess the terrain in a scenario. This allows each execution of the scenario to consult the established terrain characterization, rather than repeating a dynamic analysis in runtime. The results of this analysis are automatically incorporated into threshold values for the Cover and Concealment evaluation measure in the scenario.

Manual Editing Format for Evaluation Internals. For finer control of internal logical parameters in InGEAR evaluation measures, a spreadsheet format is provided (in comma separated value ".csv" format that can be opened in Excel). This allows for modifications to feedback text, the number of times that feedback is given in Coaching or Exercising mode, and other parameters of the evaluation measures.

Scenario Conversion Tool. This utility facilitates the authoring process by automating the first step of converting an existing scenario (developed for the previously existing *Follow Me* game versions without the InGEAR plugin) to operate with InGEAR. The conversion primarily involves adapting the scenario for execution so that the extra data flow required for InGEAR automated evaluation capabilities is supported.

Conclusion

As discussed in this report, the complete InGEAR capability has been transitioned to the USMA and is being incorporated into their tactical unit leadership training. According to instructor and simulation center feedback during the software spiral demonstrations, InGEAR supports the student-centered learning experience within these tactical leadership classes and increases an instructor's ability to tailor tactical scenarios and performance measures to specific training needs. Additionally, by providing a capability to automate tailored assessments and guidance as students work through various scenarios, InGEAR also expands the ability of instructors to identify learning trends and assess individual and class progress.

There are several avenues for applying the InGEAR technology itself or similar methods to other use cases and end users. The authors of this report published a conference paper discussing approaches for generalization and reuse, in terms of specific observations derived from InGEAR development (Jensen, Lunsford, Presnell, Cobb, & Kidd, 2013). For example, many of the tactical principles assessed in InGEAR are common to other domains and training environments. Because InGEAR is designed to support scenario authorability, where an assessment measure can be easily applied in different scenarios, this represents an initial step toward an abstracted assessment model for such measures. The benefit of an abstracted assessment model is the potential to reduce development time and cost for situated tutors with a variety of virtual environments. Additionally, because *Follow Me* shares a common engine with Decisive-Point's *Crucible of Command*, which is currently in use in other training settings, there are opportunities for porting InGEAR's assessment capabilities to other platforms.

Future research will examine the integration of InGEAR in USMA courses and assess the impact of its capabilities on student learning and key course outcomes. This research will also determine if these capabilities significantly reduce development time and cost for situated tutors across a variety of virtual training environments at USMA.

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Appendix A

Catalog of InGEAR Assessment Measures

       The following table summarizes the assessment measures incorporated into InGEAR. They are organized by category, with index numbers corresponding to indices used in the authoring tools for modifying evaluation internals. Similarly, the names of the assessment measures correspond to the names used in the InGEAR Editor.

Table A-1

InGEAR assessment measures.

#	Assessment Measure	Category	Description
101	Cover and Concealment	Tactical Movement	Dynamic assessment of movement routes for cover and concealment, based on a combination of terrain analysis and instances of spotting by the enemy. Thresholds for the values associated with good, average, and poor terrain are pre-determined and automatically derived from terrain analysis.
102	Civilian Spotting	Tactical Movement	Instances of civilians spotting blue units, or Blue units spotting civilians. In the scenario definition process, civilian units / entities may be assigned the "unfriendly civilian" attribute, which is a detection trigger for this assessment. Thresholds are defined in the InGEAR Editor for how many instances of civilian spotting may be considered good, average, or poor in a scenario.
111	Movement Techniques: Traveling	Tactical Movement	Conditions where Blue units use the Travel command in areas of the battlefield where it's not advisable due to expected contact. Polygons defined for the scenario designate areas where this measure applies. Thresholds are defined in the InGEAR Editor for how many instances of poorly chosen movement techniques may be considered good, average, or poor in a scenario.
112	Movement Techniques: Traveling Overwatch	Tactical Movement	Conditions where Blue units use the Traveling Overwatch command in areas of the battlefield where it's not advisable. Polygons defined for the scenario designate areas where this measure applies. Thresholds are defined in the InGEAR Editor for how many instances of poorly chosen movement techniques may be considered good, average, or poor in a scenario.
201	Max Weapons Effects	Direct Fire Planning	Dynamic assessment of Blue force lethality based on increases in suppression and Red unit losses. Thresholds are defined in the InGEAR Editor for the level of the calculated value that may be considered good, average, or poor in a scenario. Higher values indicate greater lethality and better performance.
202	Engaging Targets Beyond Effective Range	Direct Fire Planning	Instances where weapons are employed beyond maximum effective range. There is no performance threshold – any instance merits feedback.
203	Friendly Fire	Direct Fire Planning	Instances where Blue units receive fire from friendly units, whether this occurs as an incursion on an active line of fire, or the initiation of fire on a standing Blue unit. There is no performance threshold – any instance merits feedback.
204	Fratricide	Direct Fire Planning	Instances where Blue units take casualties from friendly fire, whether this occurs as an incursion on an active line of fire, or the initiation of fire on a standing Blue unit. There is no performance threshold – any instance merits feedback.

Table A-1 (continued)

#	Assessment Measure	Category	Description
301	Using MG Teams in the Assault	Proper Use of Machine Gun Sections	Instances where machine gun units are improperly assigned the Assault task. There is no performance threshold – any instance merits feedback.
302	Mutual Support (MG Tms)	Proper Use of Machine Gun Sections	Dynamic assessment of the degree to which units have overlapping sectors of fire and can mutually support each other. Thresholds are defined in the InGEAR Editor for the level of the calculated value that may be considered good, average, or poor in a scenario. Higher values indicate better mutual support.
401	C2 (MG Team)	Platoon C2 Capabilities	Dynamic assessment of the positioning of leader units with respect to machine guns in the same platoon. Thresholds are defined in the InGEAR Editor for the level of the calculated value that may be considered good, average, or poor in a scenario. Higher values indicate better positioning.
402	C2 (Unit)	Platoon C2 Capabilities	Dynamic assessment of the positioning of leader units with respect to other units in the platoon, to maintain command and control (C2). Thresholds are defined in the InGEAR Editor for the level of the calculated value that may be considered good, average, or poor in a scenario. Higher values indicate better positioning.
501	Personnel Strength	Unit Data	Dynamic assessment of Blue unit personnel strength based on unit data during execution. Thresholds are defined in the InGEAR Editor for the levels of personnel strength that may be considered good, average, or poor in a scenario. Higher values reflect better performance.
502	Ammunition Status	Unit Data	Dynamic assessment of Blue unit ammunition status based on unit data during execution. Thresholds are defined in the InGEAR Editor for the levels of expended ammunition that may be considered good, average, or poor in a scenario. Higher values reflect better performance.
503	Fatigue Status	Unit Data	Dynamic assessment of Blue unit fatigue based on unit data during execution. Thresholds are defined in the InGEAR Editor for the levels of fatigue that may be considered good, average, or poor in a scenario. Lower values reflect better performance.
504	Suppression Status	Unit Data	Dynamic assessment of Blue unit suppression based on unit data during execution. Thresholds are defined in the InGEAR Editor for the levels of suppression that may be considered good, average, or poor in a scenario. Lower values reflect better performance.
505	Number of Fires	Unit Data	Aggregate total of Blue unit fires, used in AAR summary report.
506	Under-utilized Units	Unit Data	AAR assessment of whether certain Blue units may have been under-utilized based on participation in movements and engagements.

Table A-1 (continued)

#	Assessment Measure	Category	Description
507	Targeted Unit Attrition	Unit Data	Aggregate scenario outcome in terms of attrition among targeted Red units, used in AAR summary report.
601	Destroy	Tactical Task	Destroy is a tactical mission task that physically renders an enemy force combat-ineffective until it is reconstituted (computed by reduction of enemy forces to less than 50%). Alternatively, to destroy a combat system is to damage it so badly that it cannot perform any function or be restored to a usable condition without being entirely rebuilt. The amount of damage needed to render a unit combat-ineffective depends on the unit's type, discipline, and morale. Polygons defined for the scenario designate areas where the Destroy task applies. Thresholds are defined in the InGEAR Editor for the expected time to complete the task. At the end of an exercise, either positive or negative feedback is given based on whether the task is completed within time constraints.
602	Fix	Tactical Task	Fix is a tactical mission task where a commander prevents the enemy from moving any part of his force from a specific location for a specific period. This may occur by engaging him to prevent his withdrawal for use elsewhere. Fixing an enemy force does not mean destroying it. The friendly force has to prevent the enemy from moving in any direction. This task usually has a time constraint, such as fix the enemy reserve force until an objective is secured. Polygons defined for the scenario designate areas where the Fix task applies. Thresholds are defined in the InGEAR Editor for the expected time to complete the task. At the end of an exercise, either positive or negative feedback is given based on whether the task is completed within time constraints.
603	Clear	Tactical Task	Clear is a tactical mission task that requires the commander to remove all enemy forces and eliminate organized resistance within an assigned area. The force does this by destroying, capturing, or forcing the withdrawal of enemy forces so they cannot interfere with the friendly unit's mission. Polygons defined for the scenario designate areas where the Clear task applies. Thresholds are defined in the InGEAR Editor for the expected time to complete the task. At the end of an exercise, either positive or negative feedback is given based on whether the task is completed within time constraints.

Table A-1 (continued)

#	Assessment Measure	Category	Description
604	Secure	Tactical Task	Secure is a tactical mission task that involves preventing a unit, facility, or geographical location from being damaged or destroyed as a result of enemy action. This task normally involves conducting area security operations. A force given the mission of securing a unit, facility, or geographical location not only prevents enemy forces from over-running or occupying the secured location, but also prevents enemy direct fires and observed indirect fires from impacting the secured location. A unit does not have to physically occupy the area immediately around the unit, facility, or geographical location it is securing if it can prevent the enemy from occupying or firing at that location by other means. Polygons defined for the scenario designate areas where the Secure task applies. Thresholds are defined in the InGEAR Editor for the expected time to complete the task. At the end of an exercise, either positive or negative feedback is given based on whether the task is completed within time constraints.
701	Protected Unit	Protected Unit	Dynamic assessment of the level or protection achieved for protected units in a scenario based on their status during execution. Thresholds are defined in the InGEAR Editor for the status levels for protected units that may be considered good, average, or poor in a scenario. Higher values reflect better protection of designated units.
801	Use of Distance Tool	Exercise Resources	Aggregate total of how often the distance tool was used, as a measure of resourcefulness, used in AAR summary report.
802	Use of LOS Overlay Tool	Exercise Resources	Aggregate total of how often the line of sight overlay tool was used, as a measure of resourcefulness, used in AAR summary report.

User Manual

Appendix B

This appendix includes excerpts of the Follow Me InGEAR User Manual, directly related to playing the game and to the feedback mechanisms provided by InGEAR described in this report. The complete manual was provided to the West Point Simulation Center and will be included with InGEAR versions of the Follow Me software.

Introduction

FOLLOW ME InGEAR is a tactical level, decision-making game that allows students to conduct rapid execution, visualization, and planning-centric learning exercises using a simulated combat environment. **FOLLOW ME InGEAR** helps to quickly close the gap between classroom theory and practical application. The game is optimized to teach small unit tactics at the platoon and company level. Using scenarios developed by instructors or course authors, students will learn how to employ fire and maneuver to close with and destroy their opponent's forces. A robust after-action review (AAR) capability is embedded in **FOLLOW ME InGEAR** allowing students to review, analyze and learn from each simulated operation. In addition, *Expert Observations* are provided to the student during game play; these observations will alert students to the potential dangers inherent in their current courses of action.

Playing the Game

Learning how to play the game is easy. This manual is designed to quickly familiarize you with the basic game mechanics. It will teach you—the player—the basic skills you will need to "play the game" at platoon and company level. In this manual, you will learn how to do the following:

1. Move ground combat units and distribute their fires.
2. Call for artillery support.
3. Breach an obstacle.

Let's get started.
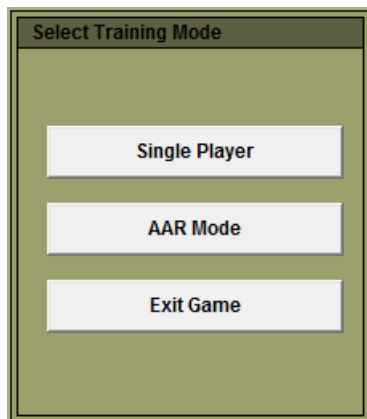
Once you've launched the **FOLLOW ME InGEAR** program a popup menu called *Select Training Mode*…will appear. Select *Single Player* by placing your mouse cursor over the button and left clicking.
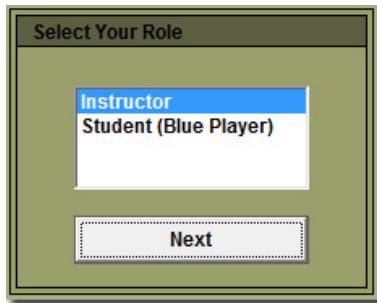
A menu will appear asking you to *Select Your Role*… Select *Blue Player* and then press the *Next* button.
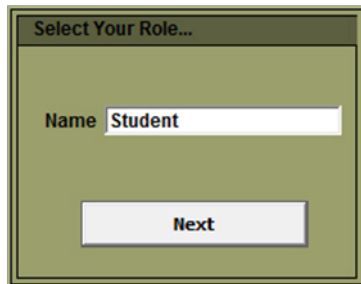
At the *Please Login*… window, type your name in the box where it says, "Student" and then press the *Next* button.

Select *New Game*…

…and the *Load a Scenario File* panel appears.

Load a Scenario File

Look in...

- C:\
- ProgramData
- Decisive-Point
- Follow Me InGEAR
- Scenarios

Coaching_CHECK_C2.igsce
Coaching_CIVILIANS.igsce
Coaching_CLEAR_Task.igsce
Coaching_DESTROY_Task.igsce
Coaching_EFFECTIVE_RANGE.igsce
Coaching_FIX_Task.igsce
Coaching_FRATRICIDE.igsce
Coaching_MASS_EFFECTS_Bad.igsce
Coaching_MASS_EFFECTS_Good.igsce
Coaching_MGTeams.igsce
Coaching_MOVEMENT_TECHNIQUES.igsce
Coaching_MUTUAL_SUPPORT.igsce
Coaching_PROTECTED_UNIT.igsce

OK   Cancel

Select the desired scenario file and then press the *OK* button. This will load the selected scenario into the game.

Game Displays

Once the scenario is loaded, you will see the main game screen. This graphical interface was designed to facilitate easy use of *FOLLOW ME InGEAR*.

Game Screen
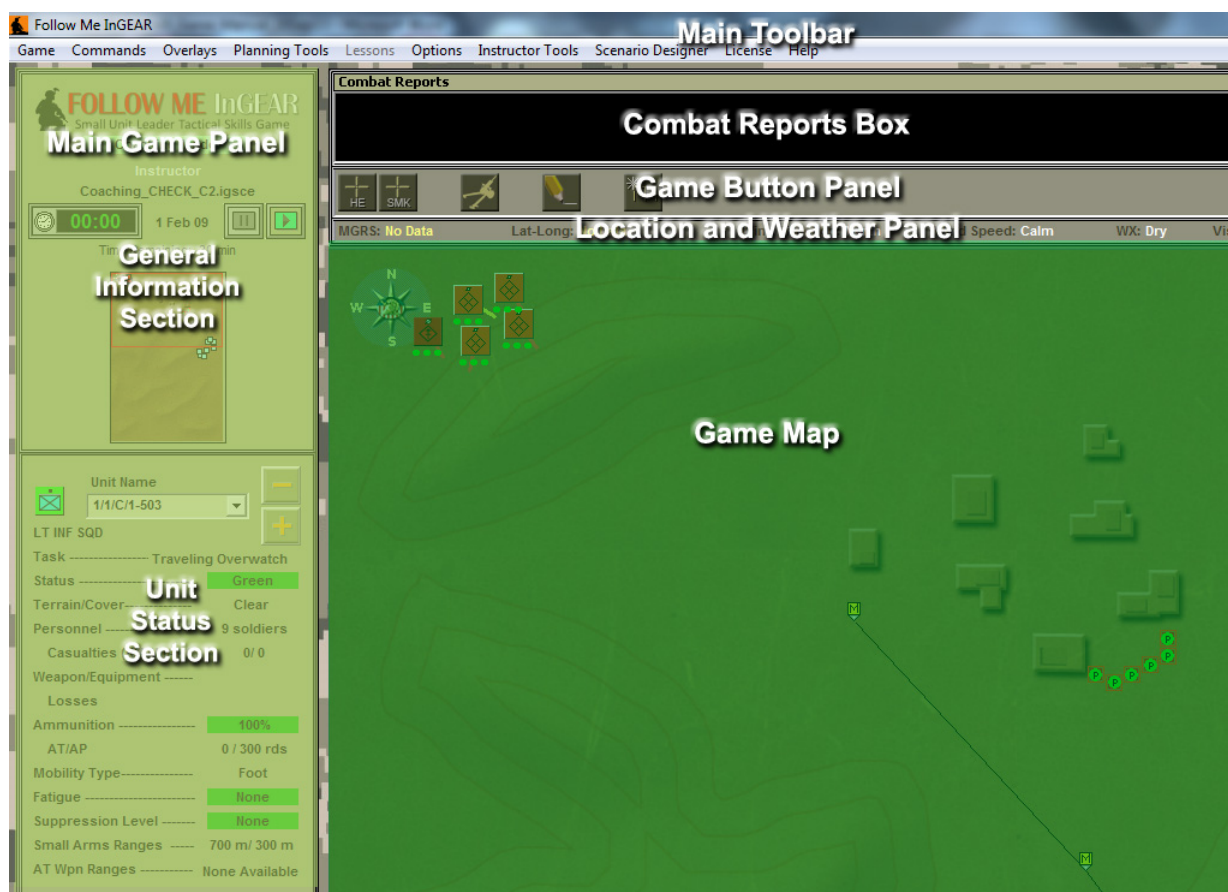
The *Game Screen* has six major components; the *Main Toolbar*, *Combat Reports Box, Game Button Panel, Location and Weather Panel*, *Game Map*, and the *Main Game Panel* (General Information Section and Unit Status Section).   The *Main Toolbar* provides the player access to the bulk of the game's functions. The *Combat Reports Box* provides real-time information from subordinate units on friendly and enemy direct and indirect fire events, vehicle and personnel losses, etc. The *Game Button Panel* contains buttons that allow the player to quickly change weapons control status or place artillery or mortar fires on the map; it also displays an assessment of the blue player's use of cover and concealment during game play. The *Location and Weather Panel* displays the Military Grid Reference System (MGRS), Latitude and Longitude (Lat-Long), and the X,Y coordinates of locations on the game map that are directly underneath the mouse cursor. The *Game Map* is where all the tactical action takes

place; moving and firing units, assaulting enemy positions, etc. The *Main Game Panel* is used primarily to provide the player with situational awareness of the time, location, and the status of his or her units.

Now let's look at each of the game screen components in more detail.

Main Toolbar
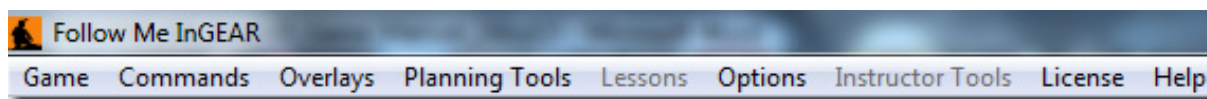
At the very top of the game screen is the *Main Toolbar*. Though there are a few exceptions, the bulk of the **FOLLOW ME InGEAR** game functions can be accessed from here. We'll talk about each of the components of the toolbar in more detail below. However, the C*ommands, Planning Tools,* and *Lessons* groups are the most important so let's talk about those first.

Commands

"Move, Shoot, and Communicate."

The *Commands* menu is the central point for directing your units. It is from here that the player can issue commands to move, shoot, and change orientation on the battlefield. The *Commands* menu can be accessed from either the main toolbar, or by right clicking anywhere on the game map. The top portion of the menu provides your "move" commands. The middle portion provides your "shoot" commands. The bottom section allows the player to *Run* or *Pause* the game.

Note: Though communications on the battlefield with superiors, peers, and subordinates is of equal importance, the "communicate" capability is limited in **FOLLOW ME InGEAR** to the messages the player receives during game play; the player cannot report his actions.
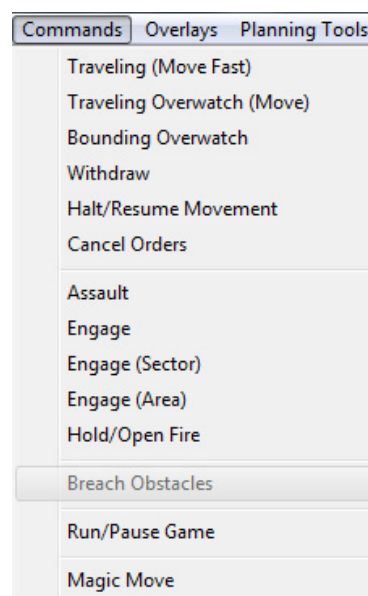
Traveling (Move Fast). A selected player unit with a TRAVELING command will move more quickly to their designated destination. However, they will also accumulate fatigue much faster. To move a unit using the TRAVELING command, right click on the unit icon. Select the TRAVELING command from the pop-up menu, and then left click on the desired destination or waypoint. Left click to set the waypoint, then right click to exit the issue commands mode. A unit issued a TRAVELING command is indicated using a green waypoint. The player has the ability to plot up to five movement waypoints for the selected unit. Once waypoints have been plotted, the player has the ability to adjust them by left clicking on them and dragging and dropping them on the new destination.

Traveling Overwatch (Move). A selected player unit with a TRAVELING OVERWATCH command will move at a slower pace than TRAVELING. This provides the unit a higher level of security and

reduces the rate of fatigue accumulation. To employ the TRAVELING OVERWATCH command follow the same techniques listed for the TRAVELING OVERWATCH command. A unit issued a TRAVELING OVERWATCH command is indicated using a yellow waypoint.

Bounding Overwatch. A selected player unit with a BOUNDING OVERWATCH command will move more quickly to their designated destination. However, they will also accumulate fatigue much faster. To employ the TRAVELING OVERWATCH command follow the same techniques listed for the TRAVELING command. A unit issued a BOUNDING OVERWATCH command is indicated using a red waypoint.

Withdraw. A selected player unit given a withdrawal command will move to their designated destination but their sector of fire/observation will face to the rear. To employ the WITHDRAW command follow the same techniques listed for the MOVE command.

Halt/Resume Movement. Selected player units given a *Halt Movement* will stop. However, they retain whatever remains of their previously plotted movement paths. Therefore, when issued a *Resume Movement* command, the selected unit will continue to move along their previously plotted movement paths.

Cancel Orders. All selected player units issued the *Cancel Orders* command will cease moving and/or firing. Any movement waypoints that have been plotted will be deleted if this command is selected.

Assault. Selected player units given an *Assault* command will use fire and movement to close with and attempt to destroy the selected enemy unit. Once established, you can adjust a unit's *Assault* destination by dragging the *Assault* cursor to the new desired destination on the game map.

Engage. A selected player unit given an *Engage* command will fire on any enemy unit within its sector of fire. It will continue to do this until all enemy units within its sector of fire are destroyed, or the unit runs out of ammunition, or the unit is issued a *Cancel Orders* or *Hold Fire* command. Once established, you can adjust a unit's sector of fire by dragging the *Engage* cursor to the new desired aiming point on the game map.
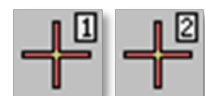
Engage (Sector). A unit with an *Engage (Sector)* command will automatically open fire on *any enemy unit* that enters its sector of fire. To designate a unit's sector of fire, select the desired unit and then right click to view the unit command menu. Select the *Engage (Sector)* command and move the cursor to the first target reference point. Left click to designate the first sector point. Now move the cursor to the second target reference point and left click to designate the second sector point. The sector will be drawn automatically once the second point is designated.
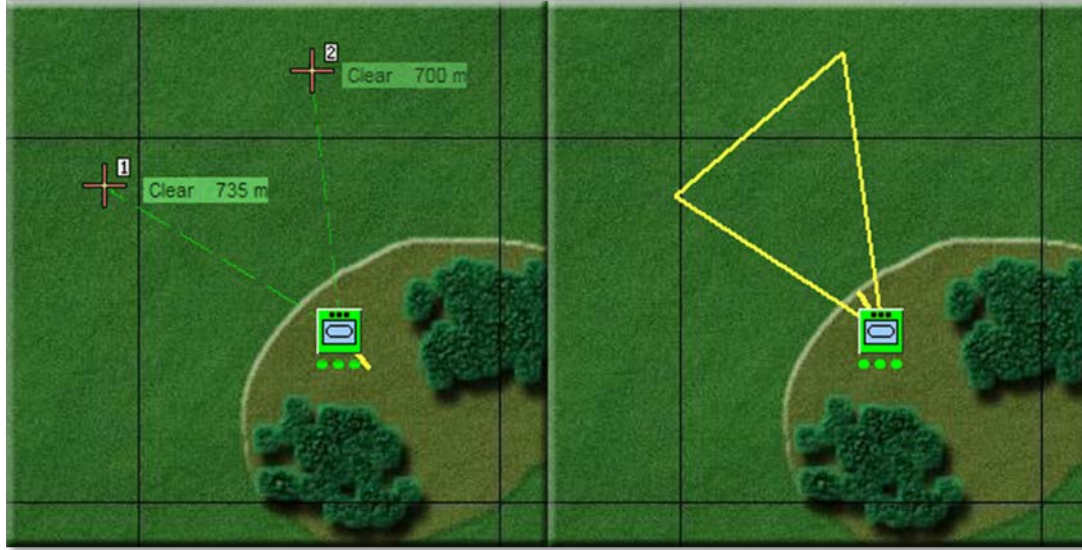
Engage (Area). A unit with an *Engage (Area)* command will automatically open fire on *any enemy unit* within 250 meters of the center of the *Engage (Area)* aiming point. Units given an *Engage (Area)* command orient their fire on the point on the map selected by the player. Once established, you can adjust a unit's *Engage (Area)* sector of fire by dragging the *Engage (Area)* cursor to the new desired aiming point on the game map.

Hold/Open Fire. A unit in *Hold Fire* mode will not engage enemy units regardless of the circumstances. A firing unit issued a *Hold Fire* command will immediately cease firing. A unit in *Open Fire* mode will engage enemy units with direct fire if the opportunity presents itself (given the unit's current facing, sector of fire, current combat command, etc.).

Maximum Range. If the current position of the cursor is located beyond the maximum range of a unit's weapon system, then a red circle with the letter 'R' will appear at that maximum range.

Breach Obstacle. A selected player unit given an *Breach Obstacle* command will move to the designated location and will attempt to breach any obstacles while enroute.

Run/Pause Game. Select this command to *Run* or *Pause* game play.

Magic Move. This command is used to move the player's units anywhere on the map at the start of a game scenario. This capability is only available to the player <u>prior</u> to selecting the *Run Game* command to start a scenario.

Overlays

Operations. This overlay displays any operational graphics that have been drawn in support of the operation. Click on "Operations" to turn the graphics on or off.

Engineer. This overlay will display all spotted engineer obstacles. Click on "Engineer" to turn the graphics on or off.

Erase All Graphics. BE CAREFUL! Selecting this command will erase all graphics in the game.

Planning Tools

Distance Calculator. The distance calculator provides the capability to measure the distance in meters between two points on the game map. To use this tool, simply click on the map to set the point of origin then drag the cursor to the destination.   Each click afterwards will add to the total distance measured. Right click to return the *Distance Calculator* to zero.
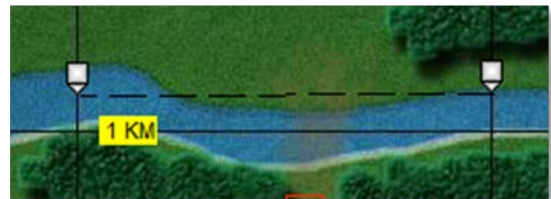
LOS On/Off. The line of sight (LOS) tool shows the player what tiles can or cannot be seen from any particular tile on the map. To use this tool left click on any point on the map and the display will show which tiles can be observed from that point. Tiles that cannot be observed are shaded in gray while the observable tiles remain the same (i.e. un-shaded).
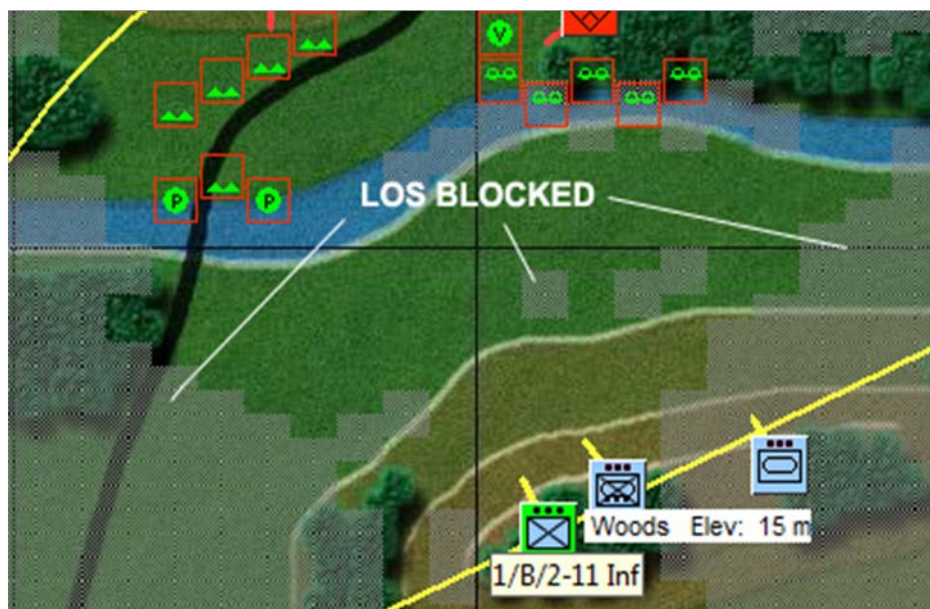
Example: Check Line of Sight Tool

Line of Sight (LOS) Blocked. If you are attempting to issue any of the "shoot" commands (*Engage, Engage [Sector],* or *Engage [Area]*) and you drag the cursor outside of the unit's line of sight, you will see a yellow circle with the letter "B" inside. This means the line of sight is blocked passed that point by some interveing terrain.

Example: Line of sight blocked

Lessons

The *Lessons* section on the main toolbar is the location for accessing any supplemental educational or reference material included with a scenario by the instructor or course author. Up to five lessons can be listed per scenario and accessed from this location.
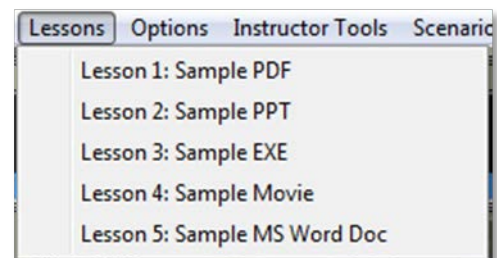
Game

End Current Exercise. Select to end the currently loaded scenario. The player will exit the game screen and be sent to the *Select Exercise Type…* menu.

Exit FOLLOW ME InGEAR. Select to exit the game.

Main Game Panel

General. The *Main Game Panel* is used primarily to provide the player with situational awareness of the time, location, and the status of his or her units. It is divided into two sections; the *General Information Section* and the *Unit Status Section*.

General Information Section

Game Modes:

Coaching Mode. This banner is displayed when the coaching mode option has been selected. While in coaching mode the player will receive expert assistance through one or more messages.. When InGEAR is used in the "Coaching Mode", it will automatically pause the game so the student has time to read the message and consider their actions before resuming the exercise.

Exercise Mode**.** This banner is displayed during game play. While in the mode, the player will receive limited coaching from InGEAR during the exercise.   Although the student may receive some messages from InGEAR, InGEAR will not automatically pause the game for the student.

Playback Mode**.** This banner is displayed during the after action review.

B-11

Game Status:
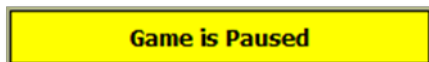
Game is Paused

Game is Paused. The yellow *Game is Paused* banner will display and blink while the game is paused. Every scenario starts out with the game paused.

Game is Over

Game is Over. The red *Game is Over* banner will display and blink when the game has reached the time limit for the scenario being played.

Player Name. The name entered by the player at game start-up is displayed here.

Scenario Name. The name of the scenario selected by the player is shown here.

Game Clock. The game clock can be configured by the scenario designer to act as a time counter or as a clock display. The time counter simply displays how many hours and minutes have elapsed since the game started. The clock display uses a standard, 24-hour military time display to show "what time it is". Regardless of the type of game clock, time passage in the game is not real-time; it has been accelerated to allow for rapid attainment of teaching points. On average, it takes 6-10 seconds of game time to represent one minute of actual combat. For example, a scenario representing two hours (120 minutes) of simulated combat might take only 20 minutes to play (assuming no pauses).

Run Game Button. Press this button and the game begins to run. The game will continue to run until the player selects the pause button or the time limit of the scenario has been reached.

Pause Button. Press this button and the game pauses. The player may continue to issue commands while the game is paused. However, commands issued while the game is paused will not be executed until the Run Game button has been pressed.

Mini-map. The mini-map is located on the main game panel. It shows the entire game map and uses very small icons to represent units. Blue icons are the location of friendly units; red icons are enemy units that can be seen by your units. You can quickly navigate the large map by clicking anywhere on the mini-map. The red box on the mini-map shows the area displayed on the large game map.

Video SITREP:

In-game Video Situation Reports (SITREPs). Some scenarios may present you with a video SITREP. This video will be displayed in the area normally occupied by the mini-map. These videos are geared specifically to provide additional information about what is happening or expected in the scenario.

Unit Status Section

General. This section is the place to look for detailed information about the status of your units.

Unit Icon. The selected unit's icon will be displayed here.

Unit Name. The selected unit's Name will be displayed here.
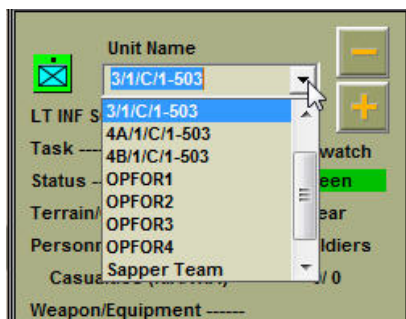
Unit Selection. Units can be selected via the unit name box. To do this click on the down carrot and a drop down menu will appear. This menu displays the units of your command. Click on the desired unit to select it.

Next/Previous Unit Buttons. Units can also be selected by cycling through them using the Next/Previous Unit buttons.

Unit Nomenclature. Other information that is relevant to the selected units type, equipment, or special abilities is listed here.

Task. The unit task shows what the selected unit has been commanded to do.

Status. The *Unit Status* displays the current percentage strength of the selected unit. One of four colors is used to show the unit's status; Green, Amber, Red, or Black.

Terrain/Cover. This field displays the type of terrain where the selected unit is located.

Personnel. This field displays the number of effective personnel remaining in the selected unit.

Casualties (KIA/WIA). Personnel killed in action (KIA) or wounded in action (WIA) are tallied and displayed here. These numbers are subtracted from the total number of Soldiers fit for duty (Strength).

Weapon/Equipment. This field displays the number of combat-ready weapons or equipment remaining in the selected unit.

Losses. This field displays the number of weapons or equipment that has been lost by the selected unit.

Ammunition. The *Ammunition Status* is displayed on the main game panel as #/#. The number to the left of the slash is the percentage of anti-tank ammunition remaining. The number to the right of the slash is the remaining percentage of anti-personnel ammunition. A unit with zero ammunition cannot Engage, Engage (Sector), Engage (Area), or Assault. One of four colors is used as a background to indicate the total ammunition status of the selected unit; these colors are Green, Amber, Red, or Black.

The total ammunition status is equal to the anti-tank ammunition quantity plus anti-personnel ammunition quantity.

AT/AP. These fields display the number of anti-tank (AT) and anti-personnel (AP) rounds remaining in the selected unit.

Fatigue. Personnel units accumulate fatigue when using the *Moving Fast* command. The fatigue level of a unit influences its movement speed. Personnel units can recover from fatigue by remaining stationary. Vehicle units do not accumulate fatigue.

Suppression Level. Suppression can occur as the result of a unit receiving direct or indirect fires. Suppression impedes a unit's ability to move and shoot; the higher the level of suppression, the more a unit's ability to move and shoot is impaired. A neutralized unit cannot move or shoot. A unit can gradually recover from suppression if it is no longer exposed to fire.

Small Arms Ranges. This field displays (in meters) the maximum range and effective range of small arms weapons possessed by a unit.

AT Weapon Ranges. This field displays (in meters) the maximum range and effective range of antitank weapons possessed by a unit.

Game Map Panel

This area displays a portion of the current scenario map. Click within this panel to issue orders or make unit selections from the map. Move your cursor to the edge of the map panel to scroll the display to other areas of the map.

Compass. The game compass is always displayed at the upper left hand corner of the map. Unless stated otherwise in a scenario's instructions, NORTH is always located at the top of the map.

Terrain. The map provides a two dimensional representation of the battlefield. Trees, streams, roads, buildings, etc. are represented graphically on the map. The player can determine the exact type of terrain anywhere on the map by placing the mouse cursor over the area in question. A label is displayed that shows the terrain type and elevation of the terrain in meters. The example to the left shows Woods terrain with an elevation of 15 meters.

Terrain Effects Table. The different types of terrain influence movement, combat, and target acquisition. These effects are displayed on the *Terrain Effects Table*. The Defense Modifier shows how much the terrain reduces the effects of enemy fire. For example, a *Bldg(Strong)* reduces the effects of enemy fire by five points. The Foot, Wheeled, and Tracked columns represent the three mobility types

in the game. The numbers in the various columns are the percentages of a unit's movement speed that it can move in any particular type of terrain.

Terrain Use Panel

This panel provides the player an assessment of his/her use of cover and concealment by all forces under the player's command.

Location and Weather Panel

Map Reference Data Section. This section of the panel provides map reference data using both MGRS and Lat-Long reference systems.

Weather Data Section. This section provides information about Wind Direction, Wind Speed, Weather (WX), and Visibility. Visibility is the maximum distance in meters that any unit can see during the game. This is a theoretical distance in that it is influenced by the presence of terrain or units that can block line of sight. In addition, this distance can change from scenario to scenario because of conditions like day, night, dawn, dusk, snow, etc. Be sure to check here at the start of the game to see what this distance is.
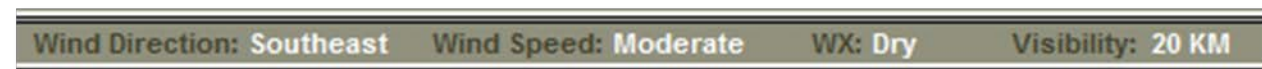
Cursor Location Data Section. This section provide the x,y location of the cursor. It also displays the game tile the cursor is hovering over.

Expert Observations

During game play, the player will be alerted when events occur that may threaten mission accomplishment. These alerts come in the form of *Expert Observations* which are provided in a pop-up window.
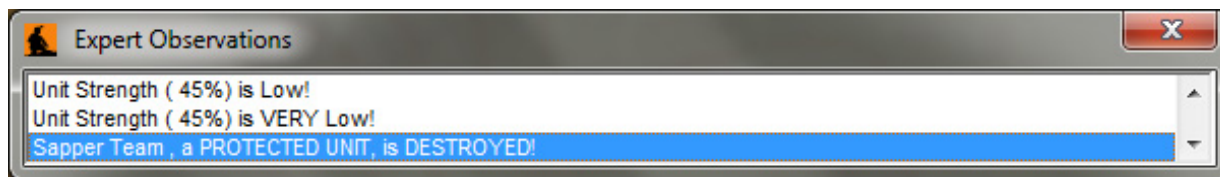
This window can be moved around the game screen to suit the preferences of the player. You can use the scroll bar on the right side of the window to scroll through the list of Expert Observations that have occurred since the start of the scenario. The player can also close the Expert Observations window by left clicking on the X in the upper right hand corner.

After Action Review

Once a scenario has been completed, the Player can review how the battle went by launching the after action review (AAR) file. Here's how to do it.

Select *End Current Scenario* from the main toolbar.
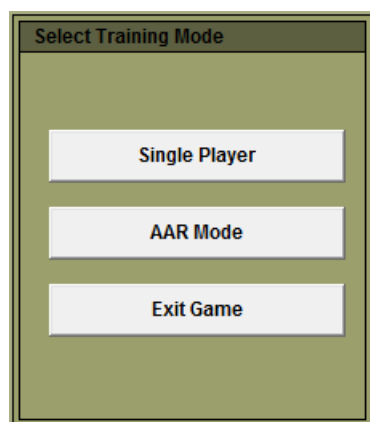
Select *AAR Mode* from the *Select Exercise Type…* menu.

Select *Blue Player or Instructor* from the *Select Your Role…* menu.
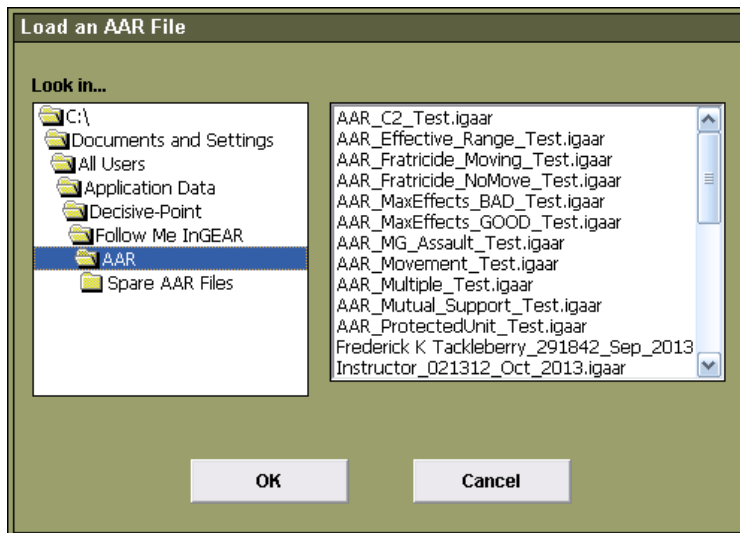
Select the AAR file you wish to review from the AAR folder.

After the AAR file loads you will see the AAR control panel displayed in the main game panel. The AAR control panel works just like a VCR or DVD player. You can play, fast forward, pause, and rewind the AAR recording. There is a scrolling device that allows you to select a particular game frame (AAR Tick) to view.

NOTE: You can also load a new AAR file by pressing the red "ejection" button.

In addition to a full playback capability, the player and/or instructor can tag critical points (ticks) throughout the AAR file and add comments about what happened or is happening at that point in the scenario.

 Next/Previous AAR Tag Buttons. Use these buttons to navigate forward or backward through the player/instructor-inserted AAR Tags.

 Add/Save AAR Tag Buttons. Press the *Add AAR Tag* button (pencil) to add a player/instructor-inserted comment in the AAR Text Box. Once the AAR comment has been inputted, press the Save AAR Tag button (check mark). Note: The background of the AAR comment text box will change colors to reflect the author of the comment. The text box background for InGEAR comments will be orange, yellow for instructors, and blue for students.

Delete AAR Tag. Press this button to delete the currently selected AAR Tag.

Bookmarks. All Expert Observations and Student/Instructor comments are bookmarked in the AAR file. This allows the instructor/student to quickly jump forward or backward to the critical events in a scenario. Simply scroll to the desired bookmark and click on it. This will move the timeline to the designated game tick and will display the situation as it was at that time during the game.   For many of the bookmarks, FM will display special graphics and effects to better faciliate the student's understanding of the comment and its location on the map.

Bookmarks	
902	! – Blue Unit Spots Unfriendly Civilians
904	X – Unfriendly Units Have Spotted a Blue U
4755	! – Unit Strength is Low
4756	+ Mass Effects
5110	! – Unit Suppresion is High
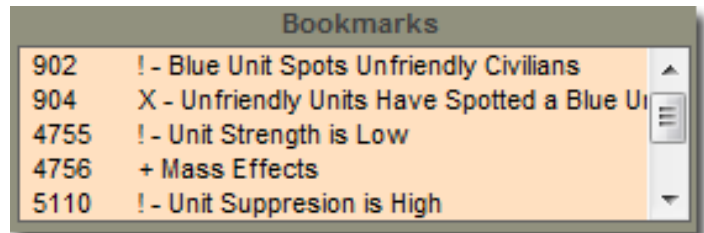
Bookmarks are numbered sequentially using an internal game clock. The numbers displayed on the left of the panel are the "game ticks" that register when the bookmarked event occurred. Bookmarks are a record of when the player received warnings or positive/negative expert advice during game play. Symbols are used at the beginning of a bookmark to allow the instructor/student to quickly assess the nature of a bookmarked event. The symbols used are described below:

!   Warning Message. A message describing an event the player needs to be aware of that may impact the success of the mission.

+   Positive Feedback Message.   A message describing an event that lets the player know an action he has taken could contribute to mission accomplishment.

X   Negative Feedback Message.   A message describing an event that lets the player know an action he has taken could contribute to mission failure.

Display AAR Summary. Clicking on this button will display the After Action Review Report. This report contains useful statistics on the performance of the player for each scenario played. It has four sections: Summary, Shoot, Move, and Command and Control (C&C). Click on each tab on the right side of the panel to view the information. To print a copy of the AAR Report, click on the printer icon at the bottom of the Summary panel. The types of information displayed on each tab is shown below:

FOLLOW ME InGEAR
After Action Review Report

Summary

Student Name	Frank Smith
Tactical Task	Destroy
Mission Status	Successful
Targeted Red Units (Destroyed)	Average (71%)
Red Units Observing Objective	N/A
Protected Blue Units	Good (100%)
Personnel Status	Poor (74%)
Ammunition Status	Good (96%)
Suppression Status	Poor (14 times)
Fatigue Status	Good (0 times)

SUMMARY
SHOOT
MOVE
C&C

FOLLOW ME InGEAR
After Action Review Report

Shoot

Number of Blue Attacks	26
Number of Red Attacks	25
Targeted Red Units	
Number of Units at Start	4
Destroyed by ENDEX	Average (71%)
Destroyed on Objective	4
Destroyed Outside Objective	0
Alive on Objective	0
Alive Outside Objective	0
Employed Weapons to Maximize Effects	Average (28%)
Weapons Used Beyond Effective Range	0
Employment of MG Teams	
Mutual Support Between MG Teams	Good (100%)
# Times Used MG Teams to Assault	0

SUMMARY
SHOOT
MOVE
C&C

FOLLOW ME InGEAR
After Action Review Report

Move

Used Proper Movement Techniques	Good
Used Covered and Concealed Terrain	Average (36%)
Observed by Unfriendly Civilians	Average (1 times)

SUMMARY
SHOOT
MOVE
C&C

FOLLOW ME InGEAR
After Action Review Report

Command and Control

Unit Command and Control	Not Evaluated
MG Command and Control	Not Evaluated
Number of Friendly Fire Incidents	0
Number of Fratricide Incidents	0
Possible Underutilzed Unit	1/1/C/1-503
Use of LOS Tool	
# Times Used During Planning	0
# Times Used Execution	0
Use of Distance Tool	
# Times Used During Planning	0
# Times Used Execution	0

SUMMARY
SHOOT
MOVE
C&C

Display AAR Data. The InGEAR AAR Data display shows the status of Blue and Red forces in the scenario over time. The instructor/player can left click anywhere on the graph and then select "Align AAR with Data Point" to advance the AAR playback to the corresponding time. This provides a quick way to see where the critical point in the battle was and to jump to that point for analysis. The instructor/player can add or substract from the data projection by clicking in the boxes provided at the lower right portion of the InGEAR AAR Data display. There is a scroll bar at the bottom of the AAR Data panel that can be used to adjust the view of the data across time.
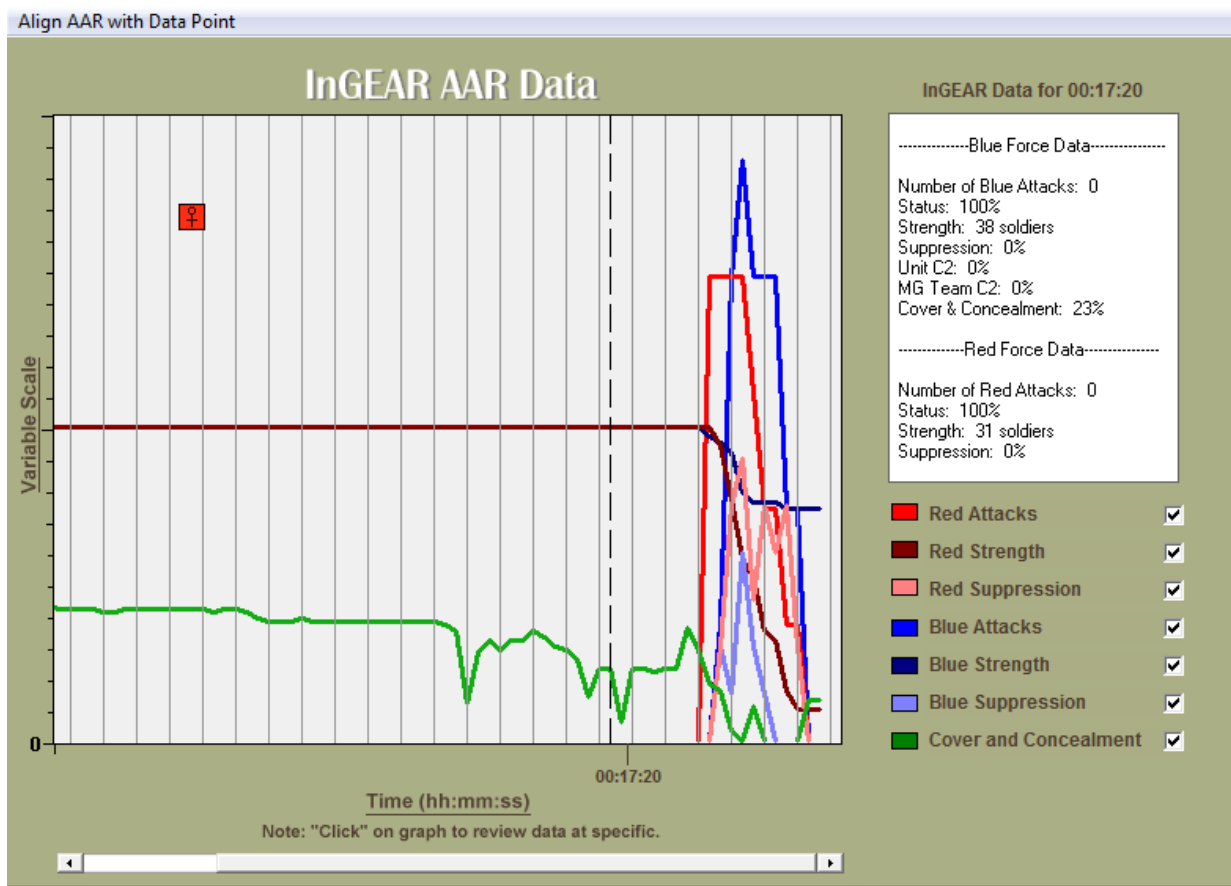
AAR Tools. There are four additional tools available to the instructor/student. Instructor View displays all friendly and enemy units and obstacles. The Blue Player View displays friendly units and graphics, and all Red units and obstacles that have been spotted. The Red Player View displays enemy units and graphics, and all Blue units and obstacles that have been spotted.
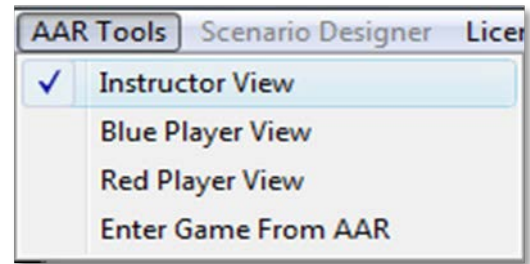
Enter Game From AAR. This is a very powerful tool. If you select *Enter Game From AAR* then you will be switched back into game play mode. Using this capability you can view the AAR file, develop lessons learned, develop another course of action (given those lessons learned), and then play out the scenario from the previous plays decisive point; this allows you the ability to obtain better results through unlimited re-plays.

FOLLOW ME InGEAR
Small Unit Tactical Skills Game

SCENARIO DESIGNER

Stottler Henke
Smarter Software Solutions

Decisive-Point

Scenario Designer User Manual

Appendix C

This appendix includes excerpts of the *Follow Me InGEAR* Scenario Designer User Manual, particularly sections related to authoring utilities described in this report supporting InGEAR functionality in scenarios. The complete manual was provided to the West Point Simulation Center and will be included with InGEAR versions of the *Follow Me* software

Scenario Designer's Guide

Introduction

The basic scenario in **FOLLOW ME InGEAR** has two components; a scenario file (.IGSCE), and a map file (.jpg or .bmp). An advanced scenario can include a number of additional optional files; a map data file (.mdf), an order of battle file (.csv), an artificial intelligence script file (.csv), and an instructor's handout (.pdf, .doc, .docx, .ppt). Both types of scenarios are constructed using the editors and tools found in **FOLLOW ME InGEAR's** Scenario Designer Suite, and/or a spreadsheet software editing program like Microsoft *Excel* or Open Office *Calc*.

There are six editors in the **Scenario Designer Suite**. They are as follows:

Area Editor. The Area Editor is used to designate geographic areas on the game map for use by the AI. These areas can be used to trigger enemy and friendly AI activities. They can also be used to trigger special effects like playing a movie or sound file, or displaying a document.

Combat Engineering Editor. This editor is used to place obstacles and fortifications on the game map. Use this editor to place wire, mines, infantry fighting positions, vehicle hull-down positions, etc. on the game map.

Map Editor. The Map Editor allows the scenario designer to import map files, set map parameters, and designate the terrain types and tile elevations on a game map.

Scenario Editor. This editor allows you to set the parameters for a scenario's nine different categories.

Unit Editor. The Unit Editor allows the scenario designer to create and modify combat units, and create and modify order of battle files.

InGEAR Editor. The InGEAR Editor allows the scenario designer the opportunity to establish training tasks and standards for a scenario.

Other Scenario Designer Tools.

Import Unit Data File. Unit data files or order of battle files can be created outside of **FOLLOW ME InGEAR** using a spreadsheet editing program. Save your unit data files as comma separated value (.csv) format and import them into **FOLLOW ME InGEAR** using the import unit order of battle file tool.

Export Unit Data File. The unit data file of the previously created scenario can be exported in .csv format using this tool. This provides another means for editing existing unit data files.

Load AI File. This tool allows the scenario designer to import a previously created AI .csv file.

Update Older Scenarios (2008-2010). There have been many significant changes in the data structure of *FOLLOW ME InGEAR*. This tool allows you to convert older Follow Me scenarios into the new format.

Combat Model Analysis Tool. This tool allows the scenario designer to test various entries on the combat results table and unit settings on the unit editor.

Getting Started

Once the subject matter for a scenario has been decided upon, the best place to start is to make the map. It is important to remember that size matters. First of all, the larger the map the harder it is for the player to comprehend the overall situation. Secondly, the larger the map, the more processing power will be consumed in line of sight calculations. On the other hand, a small map makes it more likely that weapon systems will be able to affect the entire map area. This in turn tends to restrict the maneuver options available to the players. A good rule-of-thumb is to keep maps between 1000 to 2500 pixels in height and width. Save your map as a .jpg or .bmp file in the map folder of the game directory.

Now open up the Map Editor.

Map Editor

InGEAR Terrain Analysis Tool. The cover and concealment overlay is prepared using the InGEAR Terrain Analysis Tool. Once the terrain and elevation data has been inputted, it's time to use this tool. Go to the Map Editor and select the InGEAR Terrain Analysis Tool.
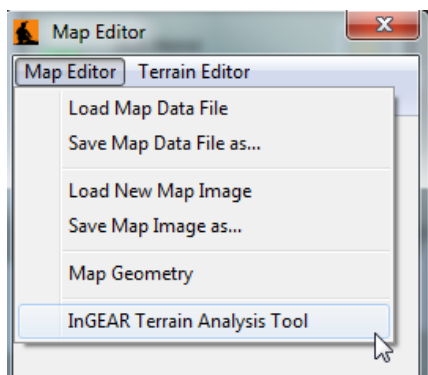
A pop-up dialog will appear…
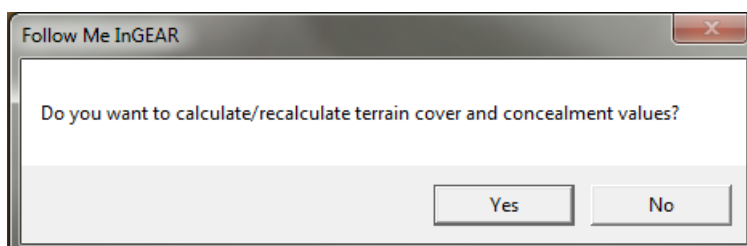
Select Yes and the calculations will begin. Progress will appear in the Combat Reports box. This process will take some time to complete; the larger the map—the longer it will take.
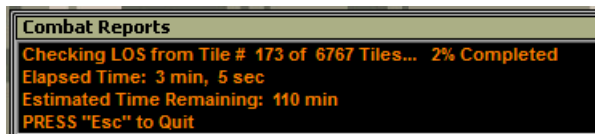
Once the analysis is complete, save the scenario file. If later you make any changes to the terrain or elevation, you will need to re-do this analysis.

Area Editor

General. This editor is used to designate geographic areas on the game map for use by the AI. These areas can be used to trigger both enemy and friendly AI activities. They can also be used to trigger special effects like playing a movie file or sound file. An area can be of any shape or size as long as it

contains at least three points. Areas are numbered and names sequentially and automatically by the Area Editor. Area # 1 is always the "Entire AO". The scenario designer can change an area name if he wishes.
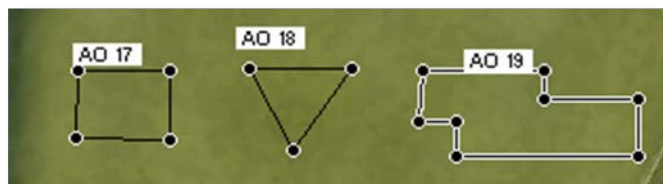
IMPORTANT NOTE: The *area number* is always used in AI scripting—not the area name.
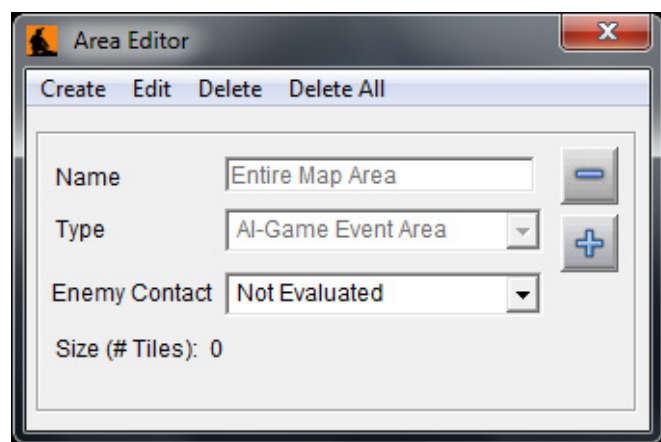
Creating an Area. To mark an area on the game map, open the Area Editor then select *Create*. Left click on the map for each point of the area. When you are ready to close the area, move your cursor to the first point that you created then right click. You have now created a defined area that can be referenced in your AI script by its Area #. To create another area select *Create* again and repeat the process outlined above.

NOTE: If you attempt to create a new area in close proximity to another, you will be prompted by a pop-up window to decide whether or not you wish to co-locate your next plotted point with one that already exists.
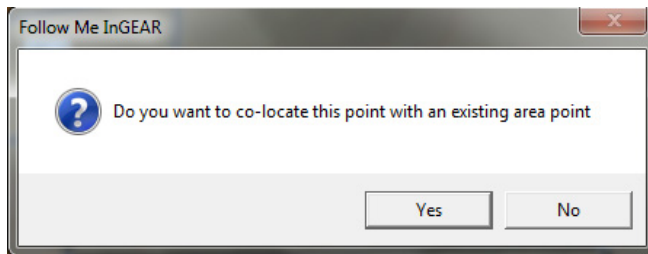
Area Types. All areas created in Follow Me InGEAR are AI-Game Event Areas.

Enemy Contact. Select the type of enemy contact to test for in the created area during game play. There are four options to choose from (Not Evaluated, Traveling, Traveling Overwatch, and Bounding Overwatch).
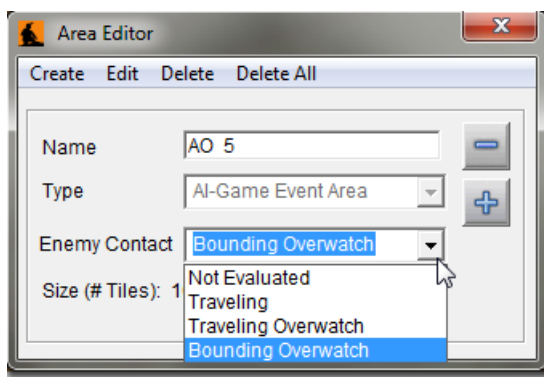
Size (# Tiles). This field displays a count of the number of tiles associated with the defined area. This is an information only field; it is calculated automatically by the computer program.

Deleting an Area. To delete an area select it by either clicking on it or using the '+' or '-' buttons. Then select Delete. To delete all previously created areas select Delete All.

Scenario Editor

General. The scenario editor performs nine functions. It allows the scenario designer to set the conditions for a scenario, and allows you to embed lessons/courseware that supports the learning objectives for the students. Each of the nine functions is described below in more detail.
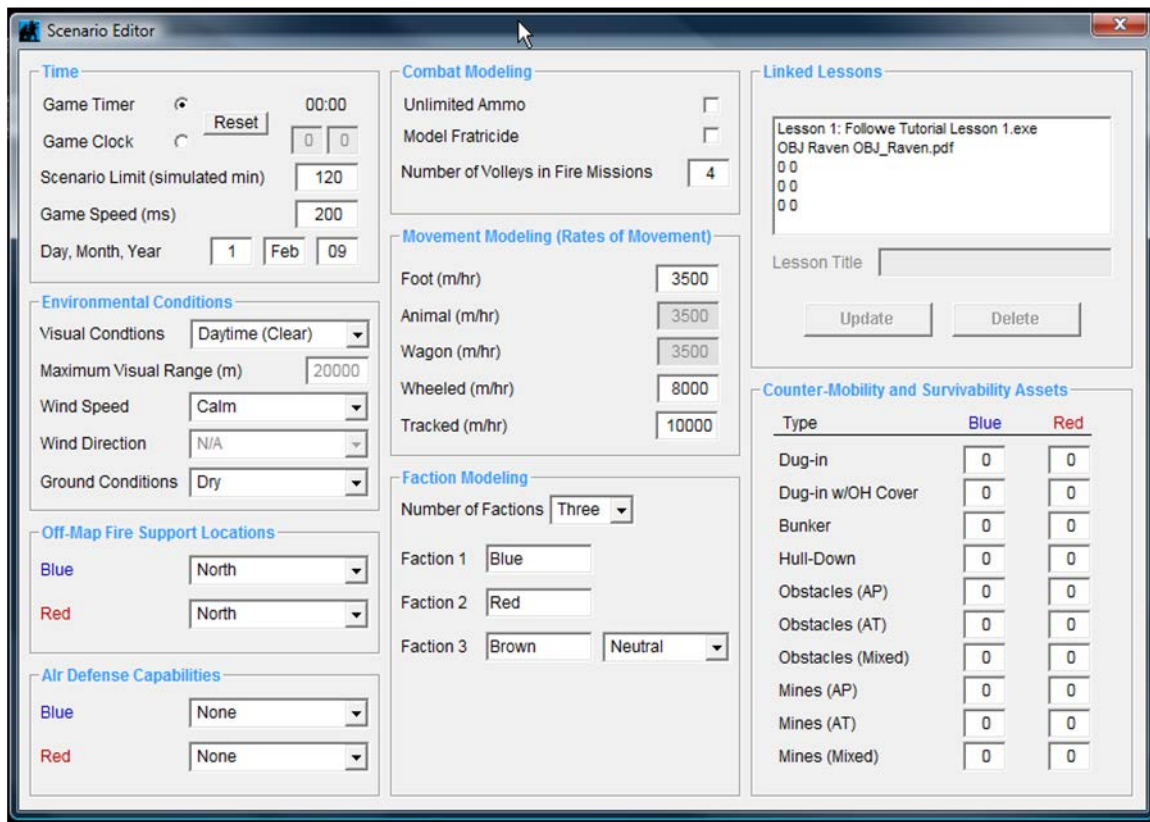
Time. The time panel allows you to designate the date, start time, and length of the scenario.
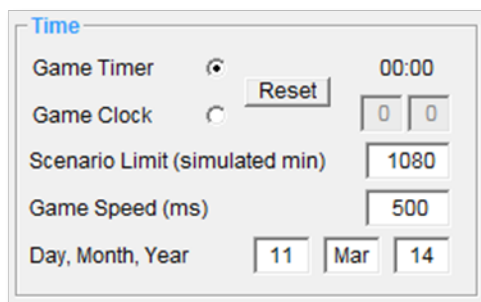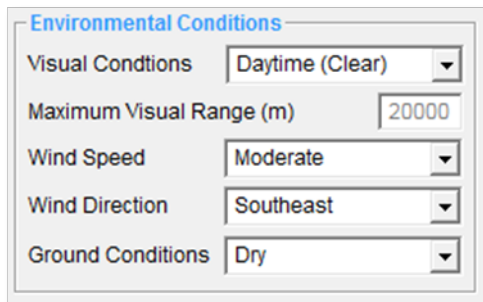
- Game Timer – Selecting the game timer means the game will use a "stopwatch-like" timer to track progress of simulated time in the scenario. It also allows you to reset the game timer of a scenario-in-progress to 00:00.
- Game Clock – Selecting the game clock means the game will use "watch time" (hours and minutes) to track progress of simulated time in the scenario.
- Scenario Limit (simulated min) – Enter the number of minutes of combat you wish to simulate. A maximum of 2800 minutes is allowed.
- Game Speed (200-10,000 ms) – Adjustments to the pulse length will speed up or slow down game play. The lower the pulse length, the faster units move and shoot and time progresses. You want to achieve a balance between how much the player has to do and how long you want the game to last. A pulse length of 200 milliseconds is about right for dismounted squad and

C-6

platoon level exercises; lesson objectives can be achieved in 5-10 minutes. For squad and platoon level exercises involving vehicles, use a pulse rate of 500 ms is recommended. For company level exercises a pulse rate of 500 ms is recommended for scenarios involving only dismounted units and 1000 ms for mounted operations.
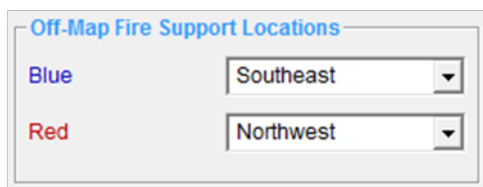
- Day, Month, Year – Enter the day, month, and year that the scenario takes place. Use the three-letter abbreviations for months (Jan, Feb, Mar, etc.).

Environmental Conditions. Make adjustments to the scenario's environmental conditions.
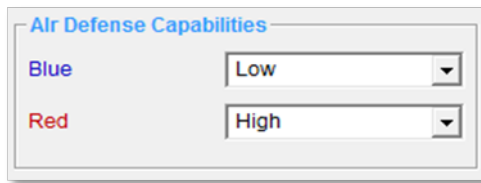
- Visual Conditions – There are three settings for visual conditions: Daytime (Clear), Daytime (Poor WX), and Nighttime.
- Maximum Visual Range (m) – The maximum visual range for Daytime (Clear) is automatically 20,000 meters. The maximum visual range for Daytime (Poor WX), and Nighttime can be adjusted by the scenario designer by entering the desired range in the Maximum Visual Range (m) box.
- Wind Speed – There are three settings for wind speed: Calm, Moderate, and High.
- Wind Direction – There are six settings for wind direction: North, Northwest, Southeast, South, Southwest, and Northwest.
- Ground Conditions – There are five settings for ground conditions: Dry, Wet, Snow, Ice, and Mud.

Off-Map Fire Support Locations. This setting allows you to designate the side of the game map that off-map fire support will come from for the Blue and Red players. There are eight support locations available: North, Northeast, East, Southeast, South, Southwest, West, Northwest.

Air Defense Capabilities. This setting allows you to designate the level of air defense capability available to each side in a scenario. There are five air defense settings: None, Low, Medium, High, and Very High.
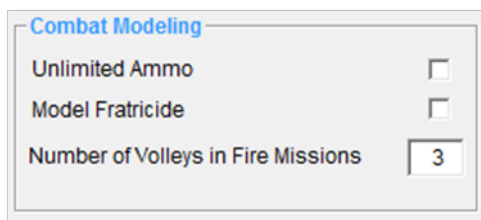
Combat Modeling.

- Unlimited Ammo – If this box is checked, then all units in the game have unlimited ammunition. In other words, no one—friendly or enemy—will run out of ammo during the scenario.
- Model Fratricide – If this box is checked, then it is possible for friendly units to fire on other friendly units.
- Number of Volleys in FFE – Enter a number 1-6. This is the number of volleys that mortars and artillery will shoot for every smoke and HE call-for-fire.
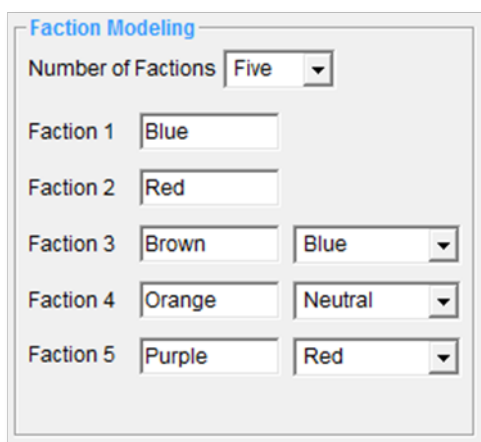
Faction Modeling.

- Number of Factions – Set the number of factions from two to five.
- Faction 1 – This faction is Blue by default.
- Faction 2 – This faction is Red by default.
- Factions 3 thru 5 – These factions can be set as Neutral, Blue or Red. Neutral units will not fire on Blue or Red units.

Linked Lessons. The scenario designer can place links to lessons and/or curriculum files into a scenario. The scenario designer can embed up to five lesson files. These lesson files can be PDFs, PowerPoint presentations, PowerPoint shows, videos (.AVI, .mov), or .exe files like FLASH or Multimedia Fusion.

Lessons/curriculum files that are used to support a scenario must be placed in the documents folder of the **FOLLOW ME InGEAR** game directory.

To add a link to a lesson/curriculum file, <u>double click</u> on one of the five lesson slots in the input box of the Linked Lessons panel. This will display a list of all the files currently located in the Documents folder of the **FOLLOW ME InGEAR** game directory. Select a file by clicking on it. Enter the name of the lesson in the Lesson Title box and then click the Update button. You are done. You can check your lesson links by selecting the Lessons menu from the main toolbar—your lesson file should be listed there.

Unit Editor

General. The *Unit Editor* is used to build the order of battle (OOB) file for a scenario. When using the *Unit Editor*, a little prior planning goes a long way towards reducing the work load. Try to determine what generic types of units you will need (e.g. US light Infantry Platoons, OPFOR Tank Platoons, etc.). Then determine the attributes of these generic units (i.e. mobility, skill, attack strengths, etc). Now create that generic unit type in the editor. Copy it as many times as necessary to fill your OOB. These generic unit copies can now be given individual unit names like "1st Platoon", "2nd Platoon", etc.—all of them created from one generic unit type.

Note. The legal entries for each field in the *Unit Editor* are defined in Appendix B: Unit Data (OOB) File.

File. OOB files in **FOLLOW ME InGEAR** are saved in .csv file format. They can be opened and edited using Microsoft's *Excel* or Open Office's *Calc*.

- Load OOB File – To load an OOB file, navigate to the OOB folder of the game directory and select the appropriate file.

- Save OOB File As… - To save an OOB file, navigate to the OOB Folder of the game directory, name the file, then select Save.

Build Unit. Click on *Build Unit* and a new unit slot is created on your OOB file.

**Copy Unit**. Click on *Copy Unit* and a duplicate is made of the currently selected unit.

Delete Unit. Click on *Delete Unit* and the currently selected unit is removed from your OOB file.

Delete All Units. Click on *Delete All Units* and the entire roster of units on your OOB file are deleted.

Note. Unfriendly Civilians. These units are used specifically to create situations that involve civilians on the battlefield for the player to react to. The presence of these units within a scenario is essential for assessing the evaluation standards of civilian spotting events.

To create an unfriendly civilian, enter the Name (10 characters max) and the Nomenclature (25 characters or less) in the appropriate fields; these labels can be anything you want (Name: "Civ-1" and Nomenclature: "Group of Armed Males" for example.

Assign these unfriendly civilians to the Red (OPFOR) faction. Select the Unfriendly Civilian box in the lower right hand corner of the Special Characteristics box.
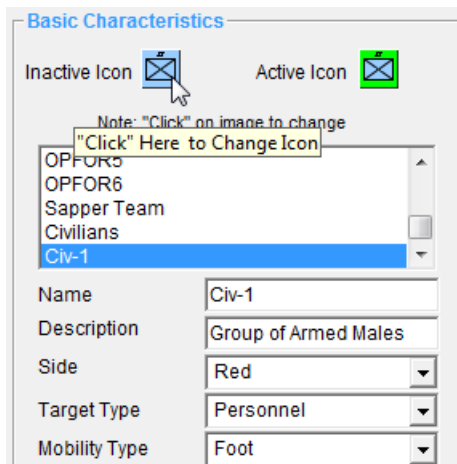
Assign the inactive icon to the Unfriendly Civilian unit by left clicking on the Inactive Icon. A pop-up menu will appear. Navigate to and select the desired icon. Foloow the same procedure for the Active Icon. Note that all active icons are represented with a bright green background.

Fill out the remaining fields as you would for a normal combat unit paying special attention to those Attack Capability fields and Special Characteristics fields that determine whether the Unfriendly Civilians are armed or not.

InGEAR Editor

The InGEAR Editor allows the instructor/scenario designer to manipulate the tasks and standards used to evaluate and provide feedback to students playing a scenario.
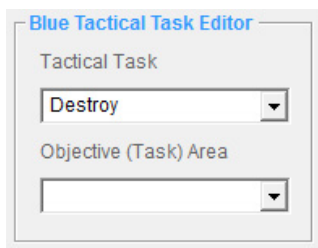

General Information.

InGEAR Mode. Select Exercise or Coaching mode. Evaluations and feedback often operate differently depending on the chosen mode. In Exercise mode, feedback in the form of real-time expert observations do not pause execution. In Coaching mode, execution pauses with each feedback message. Also there is generally less feedback in Exercise mode than in Coaching mode, although this can be specified with each evaluation. The FM_InGEAR_Messages File contains all the messages currently available. This file is located in the main game directory and can
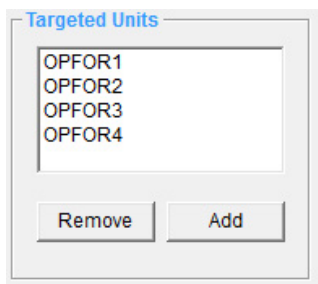
be modified to a certain extent. See Appendix C of this manual for an explanation of the editable fields on the FM InGEAR Messages File.

Task Completion Time. Select the time limit for the player to accomplish the task(s) of a scenario. The standard time limits that can be set range from 5 to 75 minutes (using 5 minute increments), or no time limit.
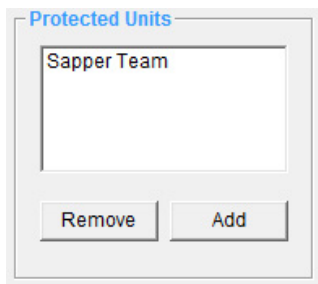
Blue Tactical Task Editor. Tactical Task. Select the task. There are five tasks to choose from: None, Clear, Destroy, Fix, or Secure.

Objective (Task) Area: None, Entire AO, or anyone of the user created AOs contained in a scenario (see *Area Editor*).

Targeted Units. This list is created from the OPFOR order of battle contained in each scenario. Select the units you wish to have evaluated as a Targeted Unit.

Protected Units. This is created from a list of all BLUFOR units in the scenario. Select the units you wish to have evaluated as a Protected Unit.

Evaluation Standards. The following standards are used to evaluate student performance and provide feedback to the student/instructor during and after playing the scenario:

```
┌─ Evaluations ──────────────────────────────────────────────┐
│                                                            │
│ ---------------------- Standard Evaluations ------------------------ │
│                                                            │
│ Friendly Fire / Fratricide                  ☑ Evaluated   │
│ Engaging Targets Beyond Effective Range     ☑ Evaluated   │
│ Using MG Teams in the Assault               ☑ Evaluated   │
│                                                            │
│ -------------- Higher Numbers Indicate Better Performance -------------- │
│                            Good        Poor                │
│ Ammunition Status          80  %      60  %   ☑ Evaluated │
│ C2 (Unit)                  55  %      30  %   ☑ Evaluated │
│ C2 ( MG Team)              55  %      30  %   ☑ Evaluated │
│ Cover and Concealment     100  %      48  %   ☑ Evaluated │
│ Max Weapons Effects         8  %       2  %   ☑ Evaluated │
│ Mutual Support (MG Tms)    75  %      50  %   ☑ Evaluated │
│ Personnel Strength         90  %      75  %   ☑ Evaluated │
│ Protected Units            90  %      75  %   ☑ Evaluated │
│ Red Unit Attrition         90  %      50  %   ☑ Evaluated │
│                                                            │
│ -------------- Lower Numbers Indicate Better Performance -------------- │
│                            Good        Poor                │
│ Fatigue Status              6  %      12  %   ☑ Evaluated │
│ Suppression Status          5  %      10  %   ☑ Evaluated │
│ Civilian Spotting           1          3      ☑ Evaluated │
│ Movement Techniques         5         20      ☑ Evaluated │
│                                                            │
│ Note: Cover and Concealment values are automatically calculated by FM │
│ InGEAR and cannot be edited by the user.                   │
└────────────────────────────────────────────────────────────┘
```

The scenario designer can select all, some, or none of these evaluation standards based on the training objectives of a scenario (see Appendix A, Catalog of InGEAR Assessment Measures for an explanation of the evaluation standards). The scenario designer can also change the percentages that define Good and Poor performance. If a measure will be evaluated, then this means that feedback will be produced (associated with the execution mode of Exercise or Coaching) in real-time and AAR. If a measure is de-selected (i.e., it will not be evaluated), then no feedback will occur during execution, and the corresponding AAR summary report results will echo "Not evaluated." If a tactical task is specified for a scenario, then it is always evaluated. However, a scenario can be defined with no tactical task.